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REACTIONS OF THE GERMAN POPULATION TO THE CHERNOBYL ACCIDENT

RESULTS OF A SURVEY

by

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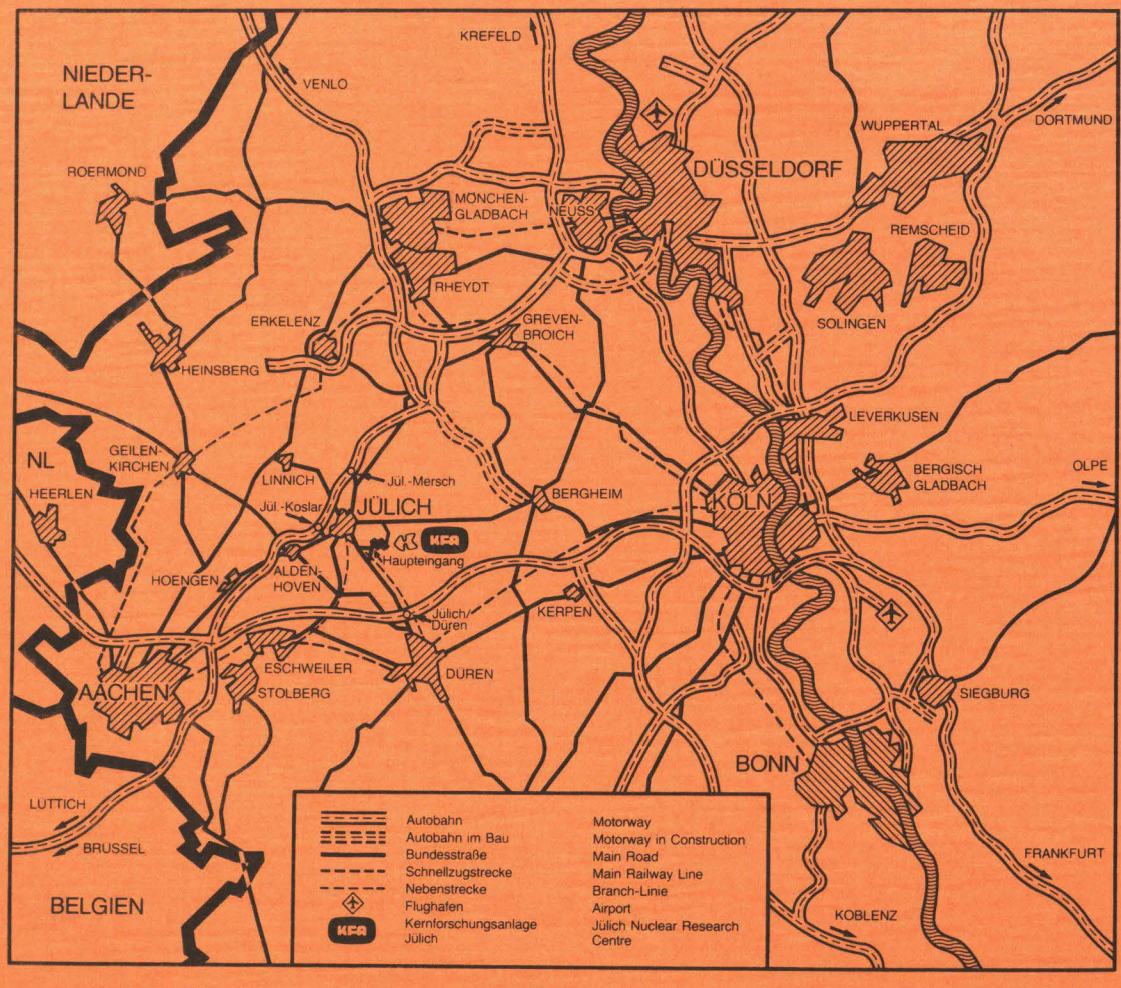

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Abstract

A representative survey of about 2,000 citizens of the Federal Republic of Germany was conducted in November/December 1986, seven months after the Chernobyl accident, to analyze the impacts of that event on the behavior, opinions and attitudes of the German public.

It was found that one major response to the event is uncertainty about the health consequences of the reactor accident. About 50 % of the interviewed people report changes in the nutritial habits of both themselves and their children. The changes in the diet, made according to recommendations made by several governmental authorities and other organizations and groups, vary strongly with the degree of education. The reasons for this are due, first, to a greater opposition to nuclear energy in general and, second, to a quicker and more consequent transformation of opinions and attitudes into behavioral dispositions within the more educated groups.

About 40 % of the respondents voted in favour of an accelerated withdrawal from nuclear energy by shutdown of existing nuclear power plants and not just by the prohibition of new ones. It is interesting to notice that not the youngest respondents are most frequently against nuclear energy but rather the 25-30 year-old age group.

Two major surprises were found when analyzing which information sources the respondents trusted: First, trust in established institutions like Government, Nuclear Research Centres and Nuclear Industry is hardly higher than that in institutions opposing the "establishment" like the Öko-Institute (a so-called "alternative" research establishment), citizens' interest groups and journalists. (The latter belonging to the cluster of anti-established institutions to a somewhat lower degree.) Second, trust in the establishment is only very slightly negatively correlated with trust in the anti-establishment. About a quarter of the population trusts both sides, the establishment as well as the anti-establishment; 15 % do not trust any side. On the average the highest trust is given the German government; the lowest the nuclear industry.

The present report just gives the results of the first step of a broad project on the social reception of the Chernobyl accident. The following steps will focus on the institutional responses to the accident by government agencies, political institutions and research establishments. Finally it is planned to analyze the function of mass media in the transfer of information about the Chernobyl accident and its consequences for the Federal Republic of Germany.

The German version of this report has been published under the title "Die Reaktionen der Bevölkerung auf die Ereignisse in Tschernobyl" as Jül-Spez-400 from the Nuclear Research Centre Jülich.

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1 Introduction

1.1 The Event

The most serious reactor accident to date occurred in the Russian town of Chernobyl on 26 April 1986. So far, the accident has claimed 31 human lives in the USSR, and a large number of late fatalities are expected. Estimates for the Federal Republic of Germany put the figure for additional deaths from cancer in the next few decades at 150[1], 375[2] or even 1,500 - 3,000[3]. Although Chernobyl is located some 1,500 kilometres from Bonn, it soon became clear, after the implications had been underestimated to start with, that the political institutions and the population of the Federal Republic would not be able to play the part of uninvolved bystanders, but would have to engage in crisis management and crisis prevention.

Considerable documentation is now available[4] on the extent of the risk to the West German population, on the actual sequence of events at Chernobyl and on the immissions in Federal territory. On the other hand, little is known - beyond the personal impressions of those involved in the crisis management - about the response of society to the nuclear accident. The events during and after the reactor disaster in block 4 of the Soviet nuclear power station at Chernobyl were unexpected as the politicians and population of the Federal Republic were unprepared for such an accident. Vaguely defined competences, decentralized decision-making, lack of jurisdiction

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1 The Deutsches Atomforum in a leaflet of 22 May 1986.

2 The KWU in its "Argumente" series, No. 57, dated 22 September 1986.

3 Professors Harald Meinhold and Klaus Koppenhagen in their contribution "Risk = Risk?" The cancer risk following the reactor accident at Chernobyl, in comparison with other carcinogenic factors in the environment, in: Forschung Aktuell, special edition on Chernobyl, published by the TU Berlin, No. 11-13, December 1986, p. 41.

4 See, e.g.

- Tschernobyl. Konsequenzen für die Bundesrepublik Deutschland: a documentation presented by the Association of German Engineers, a supplement to the "VDI Nachrichten" No. 46/86,
- Commission of the European Communities (ed.): The accident in the nuclear power station at Chernobyl and its consequences within the European Community, report by the Commission to the Council and The European Parliament, October 1986
- Gesellschaft für Reaktorsicherheit (GRS) mbh (ed.): Neuere Erkentnisse zum Unfall im Kernkraftwerk Tschernobyl (new facts on Chernobyl), GRS-S-40, November 1986
- Report by the Federal Government on the reactor accident at Chernobyl and its consequences for the Federal Republic of Germany, Deutscher Bundestag, 10th legislative period, printed matter 10/6442 dated 12 November 1986
- "Tschernobyl Info" from the Deutsches Atomforum dated 13 May 1986, with technical information on RBMK-1000, as well as:
- "Tschernobyl Info", No. 2, from the Deutsches Atomforum dated 3 July 1986, with material on the reactor accident at Chernobyl,
- "Forschung Aktuell", special edition on Chernobyl, published by the TU Berlin, No. 11-13, December 1986.

among the decision-makers and differences of opinion from the outset in assessing the scale of the danger between "established" and "alternative" experts, between the various state governments and the political parties, all made it difficult for people to find firm ground and make an adequate response - either as individuals, with a view to protecting their health (questions of nutrition), or as citizens, in view of the political consequences (future energy policy).

From a sociological point of view, the reactions in the Federal Republic to the Chernobyl accident are of particular interest, because this example can be used to study the behaviour of a social system faced with an unanticipated threat. Snap polls carried out a few days after the event at Chernobyl show that the accident had made a deep impression on public opinion: the number of convinced opponents of nuclear energy was now double the pre-Chernobyl level.[5]

Some months after the event, however, the state elections in Lower Saxony and Hamburg did not bring the definite successes that many observers had expected for the "anti-nuclear" parties, the Social Democrats (SPD) and Greens and, nine months later, the federal elections confirmed in office a government coalition that had refused to be flustered by the events at Chernobyl in its definite commitment to nuclear energy.[6] This obvious discrepancy between drastic turnarounds in public opinion on nuclear energy, on the one hand, and voting patterns, on the other, makes it clear that considerable differentiation is necessary in examining people's attitudes to nuclear energy. Compared with other political topics, eg., the economic situation, Chernobyl is evidently of less significance to the average citizen than media reactions have suggested.

Groups able to obtain effective publicity for their fears and helplessness must be contrasted with other sections of the community who are more or less indifferent in their response to the accident. This present analysis of a representative survey of the population on their perception of the Chernobyl disaster will attempt to draw a more realistic picture of population responses than we obtain if we consider only those sections of the population that are more vocal in expressing an opinion.

1.2 Projekt Design

The reactor disaster at Chernobyl prompted the Technology and Society Program Group at the Jülich Nuclear Research Centre to design a research project capable of assessing the response of society to the Chernobyl events. This research concept is based roughly on the Critical Events Analysis[7].

The overall concept of the study involves a multi-stage process of social response to the physical and biological events at Chernobyl (Fig. 1).

First of all, the event must be perceived at all before it can have social implications.[8] "Eye-witnesses", in a narrow and in a figurative sense, perceive events with their senses and with physical

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5 Allensbach polls 1984, No. 4045, and May/June/July 1986, No. 4075

6 This can be seen in the energy report submitted by the Federal Government on 26 September 1986, (Bundestag paper 10/6073).

7 Kraus et al. (1975).

8 Luhmann writes that a social system only responds to changes in its environment if these give rise to "resonances" (Luhmann, 1986, pp. 45-50). The years of controversy over nuclear energy had perfectly provided the political system with a sounding board for perceiving an event like the reactor disaster at Chernobyl. Accordingly, the accident elicited a violent response which - retaining Luhmann's terminology and borrowing from a phenomenon in nuclear physics - might be described as "giant resonance". Nevertheless, the fact that the event was integrated without any trouble into the political process does not mean that people were psychologically prepared for the event or that the political and administrative institutions had anticipated such an event as a management problem.

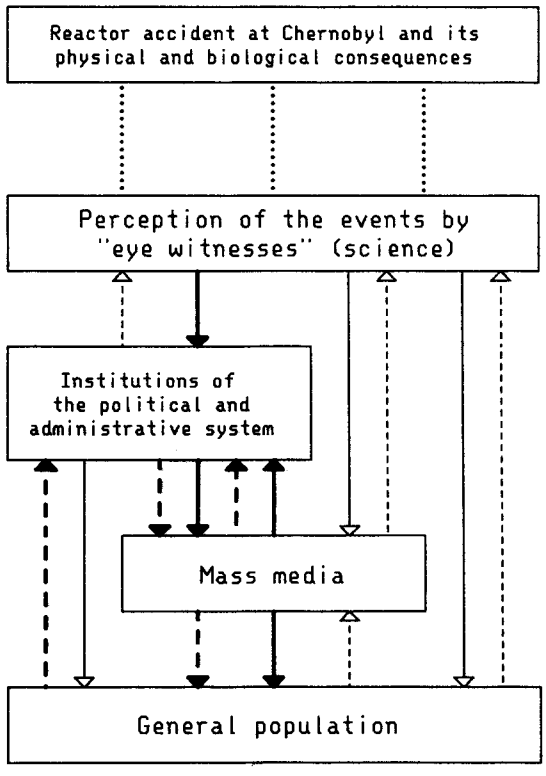

Fig. 1 Levels of processing by the social system of information on the reactor accident at Chernobyl and its interconnection by communication processes. (Solid lines in the illustration represent information on the accident at Chernobyl and its consequences; dotted lines stand for information on the responses of political actors and groups in society to these events. The thickness of the lines indicates the relative significance of the communication channel concerned.)

measuring instruments and construct a picture of what has happened. This is done initially, on a naive pre-scientific basis, by the persons on the spot. Later, the experts examine the event, using their scientific techniques and procedures. Nevertheless, the resulting picture - like any picture - no longer merely depicts the features of the subject-matter serving as a model, but also the interests of the "painter", his previous experience, his cognitive range, his cognitive categories, (cognitive paradigms) and so on. So the description of what happened depends not only on the actual event but also on the perceiver.

Any limits to the cognitive range give rise to gaps in knowledge. Thus, where no measuring station was available, the precise immission of radionuclides will remaine unknown. Accordingly, the picture that scientists have been able to draw of the events at Chernobyl and of their consequences in the Federal Republic is fragmentary.

Another point to consider is the fact that different people's "perceptions" may differ. Even scientists, who attempt to control perception by using objectifiable procedures, have their differences of opinion, especially where experience is not verifiable and measurements in the laboratory cannot be carried out under ceteris paribus conditions, but only - in the truest sense of the word - "in the field".

As a result, the picture we obtain from eye-witness reports, measurements and subsequent scientific analysis of the events at Chernobyl and their implications is neither complete nor free of

contradictions. However, within the scope of the following analysis of the response by society to the reactor disaster at Chernobyl, this picture does constitute the first level of reality: that of science.

The knowledge available at this first level on the disaster and its consequences is made public by various channels. The chief recipients in this respect are the institutions of the political and administrative system - starting with the Federal Government and its agencies, and including interest groups and citizens' action committees - as well as the media. The direct transfer of information from science to the general public by way of scientists' interpersonal contacts in the private sphere and by information events at which scientists can address citizens directly, are likely to be insignificant by comparison.

It is hardly possible to draw up a complete list of the channels used by the institutions of the political and administrative system to transfer information at various levels - from the national to the local level. The most formalized include, for example:

- Written reports
- Scientists participation as experts in discussions, conferences, committee meetings
- Answers to enquiries.

The relations between political and scientific institutions in Germany are characterized by a high degree of organizational interlocking, which is summed up here in such terms as "departmental research facilities", "national research centres", etc. The transfer of information from scientists to government institutions presented no special problems in the case of Chernobyl. The channels needed were in existence and could be used without major delays.[9]

The media receive information from the scientific field through a number of channels. This involves, eg., handing over material that has been produced for other purposes, special press releases, press conferences and interviews.[10]

The information supplied by the scientific system is processed within the system of political institutions. Assessments are made, conclusions drawn, judgements added (on relevance, dangers, consequences, need for action, strategies, etc.), and any gaps in scientific data closed by plausibility calculations. An important role in this respect is played by the various interests, intentions, basic convictions and paradigms of the political actors. Thus, the same input of information provided by science may be subjected by different actors to different evaluations and give rise to different political conclusions. This goes to explain, for example, why German Christian Democrats (CDU) and Social Democrats (SPD) responded differently to the events at Chernobyl and why different regulatory responses were triggered in the various states governed by them, although exactly the same information was available.[11]

In processing the information, political institutions can be influenced in various ways by the reactions of the population, for whose perception political institutions and politicians in particular (as a precondition for political survival in a democracy) have developed finely tuned sensors. Most of all, however, their responses depend on reports in the mass media, which inform them about how their activities are received by the public and about what is on the "political agenda" of the

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[9] Quite a different question is whether the scientific infrastructure (measuring network and central evaluation) was adequate to monitor the overall radioactive contamination in the Federal Republic at any time. In this respect, many lessons will have to be learned from the Chernobyl experience. On the other hand, these are deficits in the institutionalization of continuous scientific monitoring of the environment which cannot be discussed within the framework of this paper, and do not involve deficits in communication between science and the competent political institutions.

[10] On the channels of information transfer from science system to mass media, cf. Peters (1984), pp. 79-83.

[11] Eg., the limits for the sale of milk and green vegetables ranged from 500 Bq/l (Federal Government) to 20 Bq/l (Hesse) in the case of milk and from 250 Bq/kg (Federal Government) to 50 Bq/kg (Schleswig-Holstein) in the case of green vegetables.

day. Furthermore, they are given information on the activities of other political institutions to which they may have to respond.[12] At all rate, the processing of the information on the events at Chernobyl generates a second level of reality: that of political evaluation.

The media, as the third level in our scheme of things, report both on the information they obtain from the scientific sector and - indeed primarily - on the response of the political institutions to the events at Chernobyl. So they convey information about the behaviour of political actors, first of all to the general public, but also back to the political and administrative system. It might even be said that the political and administrative system observes (and controls) itself with the aid of the mass media.

Realistic analyses of mass media content conclude that the biggest share by far of their content is obtained from the public relations efforts of various institutions.[13] The picture we may have of a reporter rushing to the scene of some happening in order to report directly to his readers as an eye-witness is very largely a myth. This is, of course, particularly true in the case of the reactor accident at Chernobyl. Western journalists were unable to take a look at the scene of the accident. And, even the effects of the accident radioactive immissions in the Federal Republic were only available in the indirect form of statements made by scientists. Journalists, after all, do not have the necessary measuring equipment or know-how.

The media are always compelled to make selective use of the material at their disposal. In doing so, they must decide on:

- the credibility of the source of information,
- the relative importance of different information,
- the efforts required to convey this information.

Further considerations affecting the decision-making process - and varying in importance from case to case - involve, eg., questions of balanced reporting, acceptance of material by publishers, directors of broadcasting companies or radio councils, the specific expectations of the media target group and sales figures or ratings.

The upshot is that the media, too, assessed the available information, in a manner similar to that of the political institutions and - depending on basic attitudes and loyalties among media editors - arrived at different assessments of the acuteness of the danger to the population.

The result of this selection process is not a reduction in the variance of assessments of the events at Chernobyl by the political and administrative system, but an increase. This is promoted by the media's inherent tendency to focus attention on conflict rather than consensus and on extreme political viewpoints instead of cautious evaluations. On the third level, therefore, we find a media reality which is marked by a large number of contradictions both within one medium and between different media. The collection of different information, opinions and assessments to form a comprehensive picture is not performed by the mass media themselves, but is left to the individual reader or viewer.

For the general public, the media formed the chief source of information on Chernobyl, although they also provided the least orientation. As a consequence, much use was made of additional sources of information, eg., the numerous telephone advisory services or public meetings at which scientists could supply information. The ideas encountered at this fourth level in our concept are taken to be the general public's level of reality.

In keeping with the scheme of things just described, our approach involves a combination of different empirical surveys generating results that can then be interlocked.

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12 On the interdependences of political protagonists mass media and public, cf. Peters (1984), pp. 45-48, and a series of specific American studies like that of Dunn (1982) and Miller (1978).

13 Cf. Baerns (1985).

1. Non-standardized explorative interviews with families
2. Standardized representative opinion polls
3. Specific oral interviews with representatives of the main social actors (ministries, radiation protection commission, scientific facilities, interest groups, etc.)
4. Content analysis of public statements of major social actors
5. Oral interviews with journalists
6. Content analysis of mass media reporting on Chernobyl

The order in which empirical surveys are carried out is decided primarily by the neccessity of recording transitory data as soon as possible. We may assume that the reactions of the general public to Chernobyl will be most likely to be subject to a process of forgetting and modification. For this reason, the first step involved the planning and implementing of a representative opinion poll accompanied by some thirty non-standardized in-depth interviews with families in various areas of the Federal Republic, where different levels of radioactivity had been measured.[14]

Events in the political and administrative system, in contrast, can probably be reconstructed to provide valid results even after a certain interval of time, since much of what happened is documented in a written form. Again, the interviews with representatives of social actors and journalists some time after the event can also be feasible - since the interviewees were, and may still be, dealing professionally with the material. The least critical source, as far as time intervals are concerned, is the content analysis of written statements and documentation and of the mass media, which are available in archives at any time.

The present report deals in the main with the results of an analysis of the first representative surveys of public opinion on Chernobyl and discusses some of the political issues involved.

1.3 Cognitive Goals

This representative survey of the population, which - as was said earlier - constitutes only one step in a larger project design, has three main cognitive goals:

1. The first object is to examine how the general public perceived the reactor disaster at Chernobyl and its implications, especially for the Federal Republic. How dangerous was the incident considered to be?

2. The second object was to identify the consequences drawn by the general public from the events at Chernobyl, viz. in two respects

   - with regard to any change in eating habits which had been recommended by a large number of institutions through the media and advisory services, and
   - with regard to the political consequences that should be drawn for energy policy in the Federal Republic.

3. In their attempts to obtain orientation, the public was entirely dependent on secondary sources of information. Hardly anybody had any direct experience. Hence we were interested in the process of opinion-forming in the general public under conditions of absolute dependence on secondary sources, and, in particular in how the credibility of various sources of information were assessed and in the role played by television in forming opinions.

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[14] The three selected regions were: The rural district of Dithmarschen in Schleswig-Holstein, the city of Duisburg in North Rhine-Westphalia and the town and rural district of Augsburg in Bavaria.

2 Method

2.1 Questions

Our catalogue contained 16 questions of different kinds.[15] They cover the following points:

1. Perceived impact of environmental pollution on health in general.
2. Position in view of the future use of nuclear energy (shutdown).
3. Perceived cause of reactor disaster at Chernobyl.
4. Perceived safety of West German nuclear power stations compared with Russian.
5. Estimated number of fatalities as a consequence of the reactor accident at Chernobyl in the USSR and in the Federal Republic of Germany.
6. Change in eating habits as a result of the reactor disaster at Chernobyl.
7. Perceived damage to personal health as a result of the reactor disaster at Chernobyl.
8. Any action taken to protect small children (asked where the household concerned had any children under the age of 6).
9. Perceived damage to the health of children under 6 (asked where the household had children under 6).
10. Assessment of the credibility of various institutions with regard to the information they furnished on the reactor disaster.
11. Assessment of balance and accuracy in television reporting on Chernobyl.

2.2 Implementation of the Survey

The questions were presented to a representative cross-section of the population involving 1,965 persons as part of an omnibus survey held between 15 November and 5 December 1986. The statistical population was the resident German population over 14 years in the Federal Republic of Germany and West Berlin.[16]

The date of the survey was at a considerable interval, viz. approx. 7 months, after the event. This is no serious drawback, since the object was not so much to document the agitation of public opinion during the first few days and weeks after the event but to record the stable pattern of opinions and attitudes resulting from a - more or less intense - consideration of the Chernobyl events. Nevertheless, this "stability" can only be relative. Following the reactor accident at Harrisburgh, which only affected the West German population at a "cognitive" level and was not so close to home as Chernobyl, there had been a similar increase in opposition to nuclear energy in the population. Comparatively soon, however, this had declined again virtually to the pre-Harrisburgh level. Whether there will be a similar process of "forgetting" Chernobyl or whether the

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[15] The wording of the questions and the distribution of the answers are contained in the Appendix.

[16] The survey was carried out by the polling institute Infratest Sozialforschung, Munich, on behalf of the Jülich Nuclear Research Centre. The questions were compiled by the Technology and Society Program Group and finalized in collaboration with Dr. Walter Ruhland of Infratest. Following the survey and coding, the survey data were made available by Infratest as a magnetic tape and statistically analyzed by the authors.

consequence will be longer-term in view of the direct shock experienced, will be examined in repeats of our survey in the early summer of 1987 and 1988.

The interviewees were selected by a multiple-stratified multi-stage random sample. The exhaustion rate of the sample was 67 %; 10-15 % of the non-responses are to be regarded as neutral for the sample.[17]

In view of the cluster effect in the selection, there is a magnification of the sampling error - compared with a simple random selection in which the choice of one element is independent of the others. In calculating the error from shares, Infratest quotes an empirically obtained magnification factor of $\sqrt{2}$. Accordingly, the estimated errors of other parameters like correlation coefficients, model parameters, etc., which presuppose a simple random selection, may prove to be too optimistic. In view of the rather explorative character of the analysis, however, it was felt that a consistent treatment of the cluster effect in a calculation of significances and error intervals seemed to be neither necessary nor to be justified with respect to the effort involved. Throughout, therefore, we made the standard assumption of a simple random selection, so that the true statistical errors are underestimated a little.

2.3 Weighting

On the basis of a comparison of the sample with the total population, weighting factors were calculated to correct any systematic departures of the sample from the population caused, eg., by losses in interviews, taking account of the following features:

- Federal state
- Government district
- Town type (after Boustedt)
- Age
- Sex

In the statistical analysis, systematic use was made of weighted data. On the other hand, the departures of the weighted from the unweighted sample mostly concerned positions after the decimal point so that they do not affect the substantive interpretation.

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[17] Infratest figures.

3 The Results

3.1 Perception of a Threat from Chernobyl

The number of those questioned who feared serious damage to their personal health or to that of their children is clearly below 20 % (Fig. 2). Even in their answers to the general question about the number of victims in the Federal Republic, only slightly over one third of those questioned believe that more than 10 people will die as the result of delayed injuries caused by the increase in radioactivity following the reactor accident at Chernobyl (Table 1). If we compare this with the figures suggested even by representatives of the "nuclear lobby" (cf. page 1), it becomes clear that exaggerated statistical expectations of damage are held at most by minorities in the population.

On the other hand, the fact that the percentage of the interviewees who explicitly fear damage to their health is below 20 % does not mean that the vast majority of the population has no serious fears with regard to the possible health implications of Chernobyl. A considerable proportion of the interviewees answered the question about probable consequences for their health with a "don't know". Now this category can be viewed in different ways, depending on question context. In the present case, we interpret the answers in this category as indicating uncertainty.

So, although only a minority are firmly convinced that the impact of the accident at Chernobyl involves health damage for themselves or for their children, some 40 % of those questioned do not completely rule out such consequences, even though they hope and believe that they will not occur. In view of the date of the survey - more than 6 months after the Chernobyl accident - we must conclude that "uncertainty" did not just exist temporarily in the first few weeks after the disaster owing to the uproar of events, but is still very much with us - even at such a distance in time.

The results of the accompanying in-depth interviews show that the uncertainty is not necessarily associated with lack of interest in the events at Chernobyl. In fact, it initiated an intense process of analysing the information on the event, although this did not lead to any reduction in uncertainty.

The answers to three questions as to the expected consequences of Chernobyl, each of which contained as an alternative answer a "don't know"[18], were used to construct an index "uncertainty about the consequences of Chernobyl" with a value scale of 0 to 3, according to how often the category "don't know" was chosen in the three questions. This index can be employed to interpret the degree of uncertainty felt with regard to the consequences of Chernobyl. The uncertainty is clearly correlated with various sociodemographic variables (Table 2). One interesting point is that, among women, uncertainty grows with age, although no definite relationship of this kind can be observed among men (Fig. 3). So, elderly women are the population group that suffers most from the uncertainty associated with the consequences of the reactor disaster at Chernobyl. This is even more the case where the women are widows.[19]

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[18] See Appendix: questions 4, 5 and 9.

[19] Why this is so is not quite clear. Two explanations seem possible. First of all, most women over 55 are moulded by the traditional roles assigned to man and woman, according to which the private domestic

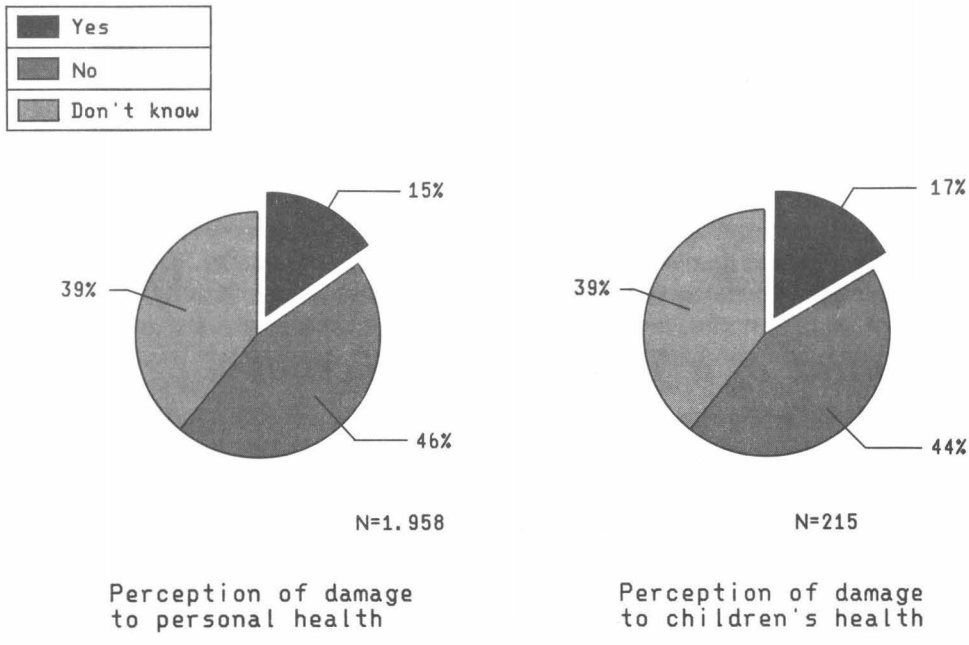

Fig. 2 Perceived damage to personal health and health of one's own children

An index "general environmental sensitivity"[20], calculated from three individual questions, measures the degree of expected damage to health from environmental pollution in general. This correlates in a highly significant fashion, though with a mean intensity of only ($\tau_b = 0.25$), with the perception of a specific risk to health from Chernobyl. As expected, Chernobyl has alarmed specifically those who are especially sensitive to environmental pollution in general.

Contrary to our expectations, the mean figure for the concern felt about children's health is no greater than the concern felt by the interviewees about their own health, if we consider the group of interviewees with children under the age of 6. Quite the contrary: more interviewees in this group state that they feel their own health is more at risk than that of their children. The reasons

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sphere is primarily a woman's responsibility and the "public" activities are a man's concern. Accordingly, uncertainty is likely if judgements are expected on public matters, but the man is not available as the competent "authority". Another conceivable explanation is that the death of the husband entails a reduction in interpersonal contacts, although these contacts have an important function when it comes to assessing information (eg. from the mass media), especially where such information is contradictory.

20 To obtain the index, three statements were used to which the interviewees could respond with approval or rejection (see question 1, Appendix). The three statements were:

1. Present-day life expectancy, i.e. the fact that people now live longer than they used to do, shows that pollution has no serious impact on health.
2. Although pollution does involve a risk to health, this can be restricted by taking proper action.
3. Illnesses caused by pollution represent one of the gravest threats today, and medicine is hardly able to protect us.

Where only the first or the first and the second statements were approved, the environmental sensitivity was classified as "slight". Approval of the second statement rated an "average", that of the second and third statements a "strong", and approval of the third only "very strong". Interviewees who gave inconsistent answers (affirming the first and third statements) or undifferentiated answers (affirming or denying all three statements) were excluded (13.7 % in all), as being "unclassifiable", from the ordinal scale.

	%
None	13.1
< 10 people	5.1
10-100 people	6.7
100-1,000 people	11.3
1,000-10,000 people	9.3
10,000-100,000 people	4.3
> 100,000 people	2.8
Don't know	47.4
	100.0 (N = 1,953)

Table 1 Presumed number of fatalities in the Federal Republic owing to the reactor disaster at Chernobyl

	Own children	Sex	Education	Age
General environmental sensitivity	0.04	0.02	-0.01	-0.07 **
Nuclear energy risk compared with UdSSR	0.02	0.18 **	-0.07 **	-0.09 **
Perception of damage to personal health	0.02	-0.01	0.05 *	-0.08 **
Change in personal diet	0.07 **	0.09 **	0.17 **	-0.03
Position on use of nuclear energy	0.00	0.12 **	0.03	-0.05 *
Uncertainty about Chernobyl consequences	-0.06 **	0.11 **	-0.14 **	0.16 **

Measure: Kendall's τ_b

* significant at 5-%-level
** significant at 1-%-level

Table 2 Associations of some substantive variables with sociodemographic criteria

for this are not quite clear; the interviewees may feel that most infants had been given special baby food, so that a risk to their health can be ruled out. The difference between this group and those who perceive health risks for themselves and/or for their children is not significant, however. So one should avoid overinterpreting this result. What is very clear is that there is a high correlation between the perception of damage to personal health and to that of one's own children ($\tau_b = 0.61$).

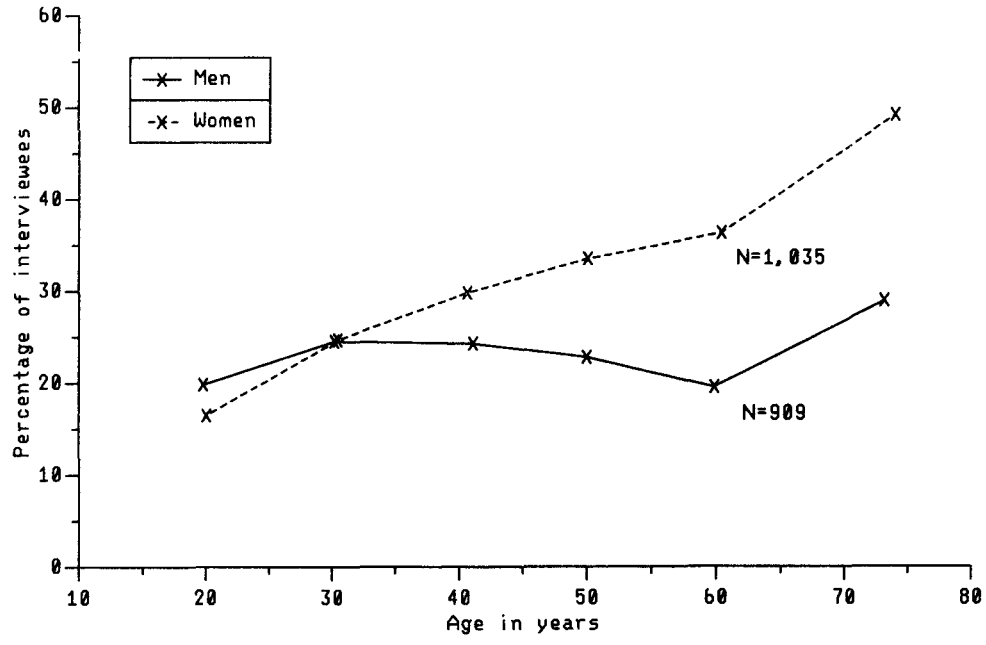

Fig. 3 Uncertainty on Chernobyl consequences as a function of age and sex (proportions of interviewees with high uncertainty - index values 2 and 3)

3.2 Consequences I: Changes In Eating Habits?

In view of the media reporting on the radioactive contamination of food and the recommendations published by various agencies on restricting the consumption, eg., of fresh milk, salad, game and wild mushrooms, it is quite surprising that these recommendations, though disseminated with considerable publicity, were followed by less than one half of the population (Fig. 4).

It is not quite clear how precisely the answers given by the interviewees reflect the extent of actual changes in diet. On the one hand, it is possible that many men did not even notice changes to their bill of fare at home. This might explain why definitely fewer men than women stated that they had changed their diet. On the other hand, considerable normative pressure from public opinion to change nutritional patterns, especially in view of small children, definitely did exist. This pressure would make the answer "yes" to our question about changes in nutritional patterns appear socially desirable, so this may tend to overestimate the extent of actual changes made. We may plausibly assume that our data exaggerate rather than underestimate actual changes in eating habits.

Basically, the changes affected a partial avoidance of salad and fresh vegetables, fresh milk and fresh milk products, wild mushrooms and game.[21]

Unfortunately, no figures are available as yet for radiological contamination in Germany with a breakdown by state, although a comparison of the percentages of the interviewees who stated that they had changed their eating habits with rough estimates of the actual contamination in the

[21] Although the point was not examined in further detail, the percentage of the interviewees who stated that they had gone without game and forest mushrooms because of Chernobyl seems to be too high. The percentage of the population that consumes game and forest mushrooms with any regularity is likely to be much less than the over 65 % who stated that they had gone without such food because of Chernobyl.

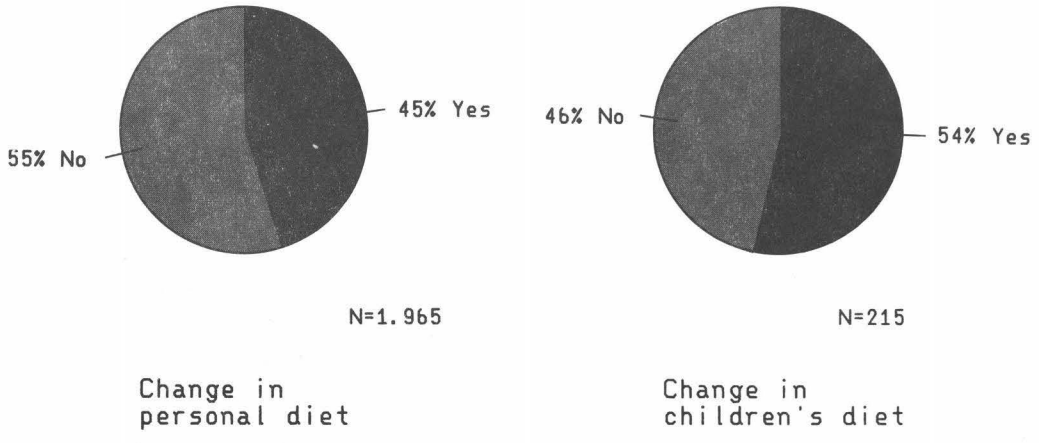

Fig. 4 Proportion of interviewees who change diets for themselves and for their children after Chernobyl

various federal states does suggest that the frequency of dietary change is hardly correlated with actual radiological contamination in the area concerned.

In fact, changes in diet vary considerably with sociodemographic variables. In addition to the already mentioned association with the sex of the interviewees, there is, most of all, a close relationship with educational levels. In addition, nutritional changes occur, on average, more often in households with children below the age of 6. This latter effect is again dependent on educational levels and is particularly striking at the highest levels (Fig. 5).

Since the media referred again and again to the special risk to children from radioactively contaminated food, it is not surprising that changes in eating patterns occurred particularly often in households with small children. In addition to the objectivly existing higher risk to infants, one psychological factor often revealed in the accompanying in-depth interviews may have played a role: as long as the health risk from radioactively contaminated food only concerned the interviewees themselves, those questioned were on average much less worried than where the risk also concerned other persons in the household - eg. spouse or, and above all, their children. From a feeling of responsibility towards dependents (with respect to food), the interviewees tend to be over-cautious - measured against their own assessment of the risk.[22]

It is by no means the case that interviewees with a lower educational level - in general terms - express less concern about the effects of environmental pollution on their health than others with a better education. Nonetheless, interviewees with a better education did alter their eating habits more often than those with less education. This may be due to an cognitive overtaxation of the latter group. Faced with a range of fragmentary and, in some cases, contradictory information, the consequences may be a paralysis of the willingness to act - dependent on cognitive abilities. Less well-educated interviewees presumably find it hard to draw consequences for action from their attitudes.

Another - equally plausible - interpretation is that less (half-)knowledge means less fear. Since - taking a realistic view - even those with a higher education will have, at most, half-knowledge about dosage effect relations and the extent of a risk, and this half-knowledge will tend to emphasize the threatening aspects, it would appear plausible that a higher level of information will tend, on average, to be accommpanied by a feeling of being at risk. And in fact, the distribution

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22 Further analysis of the data showed that this explanation is in fact only true of the women questioned and not of the men (cf. Chapter 3.5).

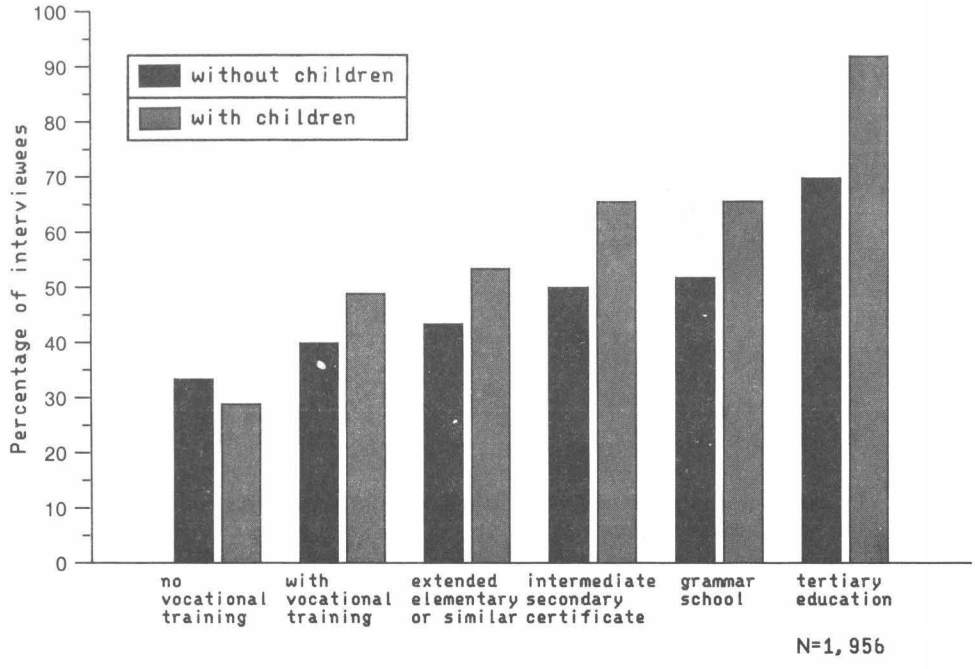

Fig. 5 Changes in personal diet after Chernobyl as a function of education, for interviewees with and without children

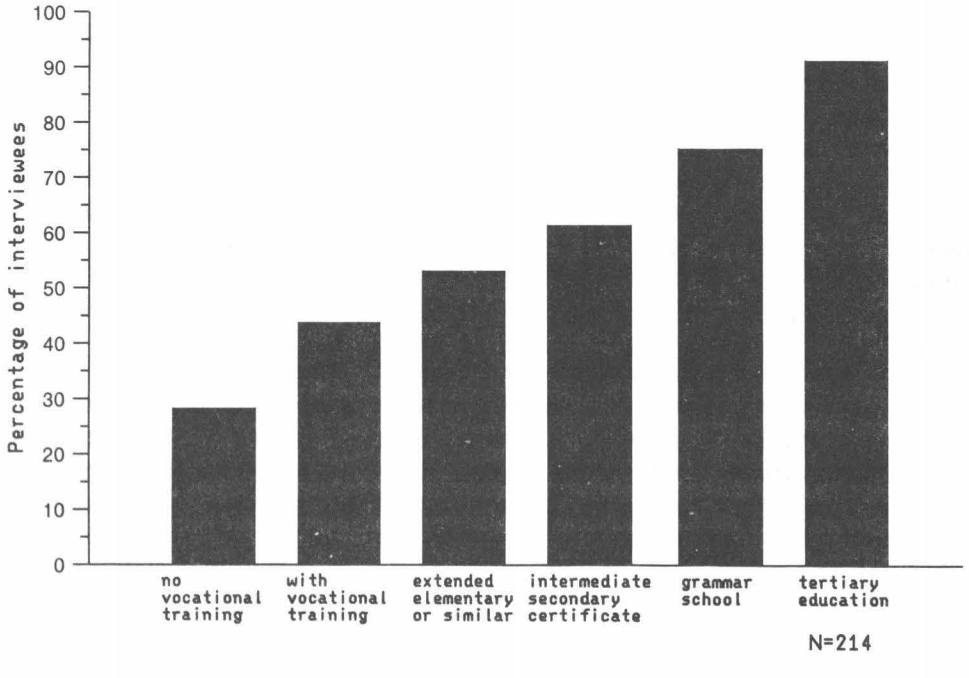

Fig. 6 Changes in children's diet after Chernobyl as a function of education

of the answers to the question about the risks to personal health from the Chernobyl accident does show this educational effect - although weaker than in the change of diet (Table 2).

People with children of their own under the age of 6 were asked separately if they had changed the diets of these children. For the reasons discussed above, interviewees with small children did, on

average, change the diets of their infants and pre-school children as well as their own diets more frequently than interviewees with out small children. The change in diet for small children is very highly correlated with the change in interviewees' own eating habits ($\tau_b = 0.66$) which indicates that, in most cases, the eating habits of the whole family and not of individual members were changed.

Even more so than in the changes to personal eating habits in the population as a whole, we find a connection between changes in children's diets and level of education in that section of the interviewees with small children (Fig. 6). Three times more graduates stated that they had changed their children's diets than interviewees in the lowest educational group.

3.3 Consequences II: Rejection of Nuclear Energy?

Chernobyl was obviously an occasion for many people to reconsider their attitudes to the use of nuclear energy in the Federal Republic. Many saw this as a confirmation of their demand that the use of nuclear energy be confined to a transitional period or even be discontinued at once.

A question on the future use of nuclear energy was intended to obtain an answer that was as differentiated as possible on how the population of the Federal Republic views the future of (nuclear) energy policy. The alternative answers were formulated in such a way as to outline - in a simplified manner - the chief political positions on nuclear energy as advocated after Chernobyl:

- We should use as much nuclear energy as possible and, wherever necessary, build further power stations ("as much as possible")
- We should maintain the present level of nuclear energy and build new nuclear power station only when existing stations are shut down ("maintain current level")
- We should use the nuclear power stations now in operation or under construction until the end of their life, but not build any new stations ("no new nuclear power stations")
- We should shut down our nuclear power stations in the course of the next few years and entirely dispense with nuclear energy ("slow withdrawal")
- We should shut down all our nuclear power stations at once ("immediate withdrawal")

For some assessments, the last two categories ("slow withdrawal" and "immediate withdrawal") were combined and called "accelerated withdrawal", since these two options involved definite decisions on shutdowns and not merely a rejection of new licensing procedures.

Nearly two thirds of the interviewees advocate - more or less rapid - discontinuation of nuclear energy in the Federal Republic (Fig. 7). Of this total, some 40 % are in favour of an accelerated withdrawal, ie. of the shutdown of nuclear power stations before the end of their normal lives. The radical energy-policy position of immediate withdrawal is supported by less than 10 %. On the other hand, only about 7 % of the interviewees are in favour of expanding nuclear energy.

The attitude to the nuclear energy question again reflects familiar sociodemographic patterns (Table 2). Accordingly, younger interviewees rather than older, women rather than men and people with more rather than less education advocate accelerated withdrawal. On the other hand, only the dependence on the sex of the interviewee is of any importance; this indicates that any interrelationship with age and level of education is not linear and that the interaction effects between sociodemographic variables may be considerable.

Concealed behind all these weak associations, there are many surprises in details. Hence, the relations between the rejection of nuclear energy and age is by no means monotonic (Fig. 8). In fact, the greatest degree of rejection is encountered among the 26-30 year-olds, ie. not among the youngest interviewees. A similar result was obtained - using quite different methods - in 1979 by Renn in a survey covering five towns and cities in North Rhine-Westphalia (Renn, 1984, p. 273).

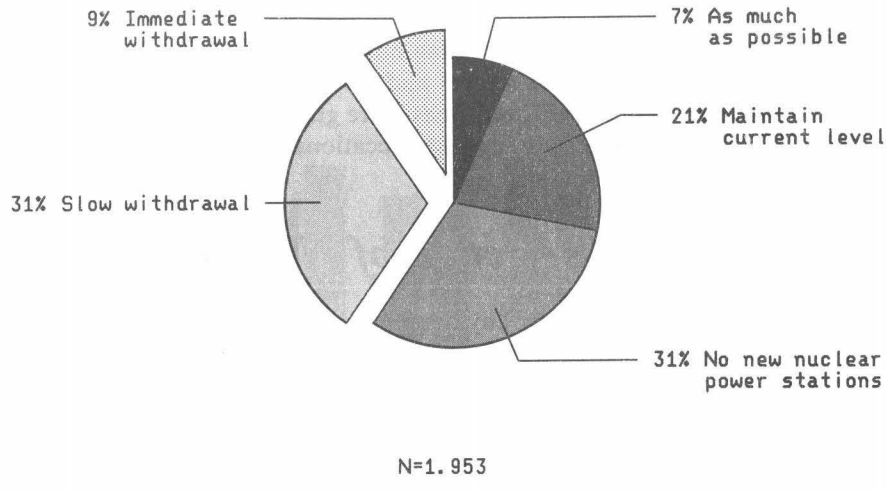

Fig. 7 Position on use of nuclear energy in the Federal Republic of Germany after the events at Chernobyl

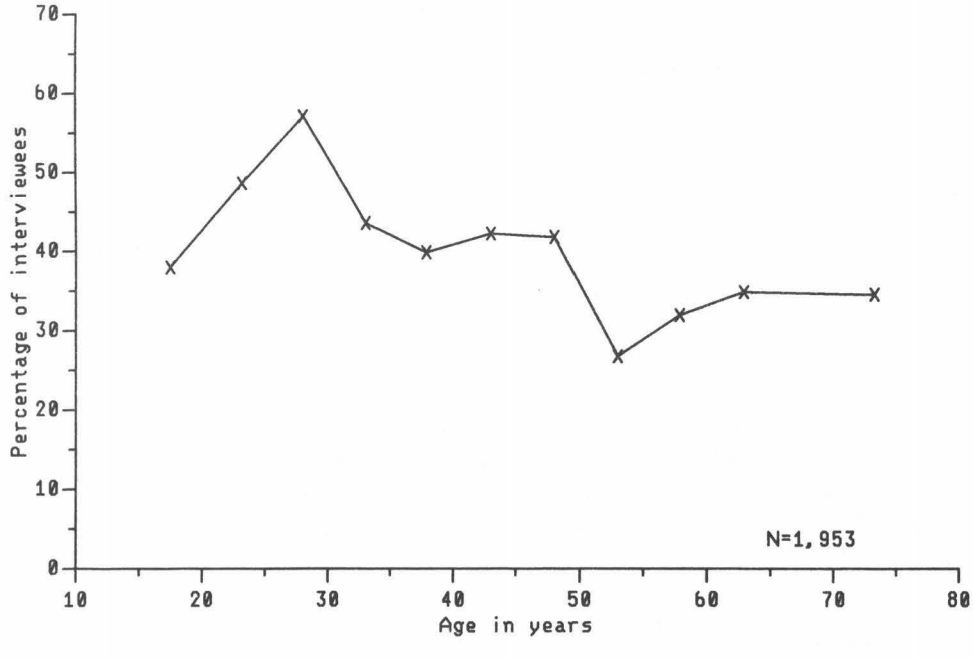

Fig. 8 Advocates of "speeding up" withdrawal from nuclear energy as a function of age

The explanation of this finding is not trivial. In the first place it is not clear whether this is a cohort effect, i.e. with the maximum of rejection moving in time through all age groups, or whether it is a life-cycle related effect, so that the peak will be found at this point in later surveys as well. Accordingly, there are two classes of explanations:

1. Explanations which are based on changes in attitudes among individuals going through various phases in their lives, and
2. those based on changing socialization conditions and "conditioning" in the interviewees' youth, like the post materialism theory of Inglehart (Inglehart, 1977) and postulating a change in attitudes from generation to generation.

A decision between the two alternative explanations would require a time series analysis covering several decades, for which we lack the necessary data. Nonetheless, some hypotheses should be discussed here.

The obvious assumption, that the peak is mainly caused by the parents of small children being particularly afraid of the consequences of radioactive contamination from nuclear power stations, can be refuted with the facts. If we exclude interviewees with children of their own from the analysis, the peak among the 26-30 year-olds is even more marked. So it is not the worried parents who account for the maximum among those advocating withdrawal, but as a more precise analysis shows students and young academics who are especially often in favour of withdrawal from nuclear energy.

Another plausible explanation refers to the fact that the present generation of 26-30 year-olds was the last to be politically "conditioned" as 12-16 year-olds before the first oil crisis in 1973 i.e. in the final heyday of euphoric growth, whereas the following cohorts grew up under the influence of the "limits to growth", the energy crisis, etc. and experienced the availability of energy as a problem. This explanation is based on Inglehart's socialization hypothesis, according to which those values are regarded as being especially important that were felt to be threatened during a critical phase in young people's socialization process (Inglehart, 1977, p. 72ff.).

Presumably, factors like the experience of shortage or indicators of shortage, as well as other factors like the dominance of certain values dependent on a particular phase in our lives play a role which is reflected, for example, in the fact that economic values are felt to be rather unimportant until the time comes for us to assume the responsibility for a family or the continued existence of a business company.

Much the same argument can be used to explain the minimum in the rejection of nuclear energy among the 51-55 year-olds. This is the group of those who bear a special responsibility in business life, who grew up during and after the War under the influence of genuine want, who in the post-War years, worked on the economic reconstruction in Germany and, in the process, internalized the goals prevailing at that time.

3.4 Confidence in Institutions and Media

The formation of public opinion on the events at Chernobyl and the consequences for the Federal Republic was largely based on information that was available only through the impersonal channels of the mass media. At the same time, this information was contradictory in a double sense:

1. First of all, contradictory assessments from various sources were quoted in one and the same medium or contribution: the opinions of the Greens and the SPD were contrasted with those of the Federal Government.
2. Secondly, there were serious differences in the accounts given by various media or editors, and these were reflected in the sources selected in each case, in the way the information was quoted and, finally, in the commentaries given.

The reader or viewer, who generally uses more than only one medium, say television, radio, newspaper and magazine, can only find his way through this mass of often incomplete and incomprehensible information if he has effective heuristic strategies for information reduction and aggregation at his disposal. In view of the remoteness of information on radioactive contamination

from everyday life, it is hardly possible to evaluate the content of the information[23]; all the individual can do is to rely on the credibility of the sources of the information, and people do believe they judge this.[24] Whether people believe a source of information or not depends on a large number of factors, like

- familiarity of the source of information
- status of the source of information
- past experience with the source of information
- social proximity to the source of information
- credited competence
- presumed dependence on or independence of interest groups[25]

The relative importance of these factors will, in turn, vary with the political commitment, the educational background, age, etc. of each individual.

Confidence in the evaluation of information can be encountered at two different levels:

1. Firstly, credibility is allocated at the level of the primary communicators like the Government, interest groups, parties, organizations (research facilities, etc), associations and citizens' action committees. The media inform the individual about the views of the Federal Government, opposition, scientists from nuclear research centres or the Ecological Institute and - depending on his assessment of their credibility - will, should contradictions arise, trust the one side or the other. He will try to assess which side is exaggerating and which side is playing down the issue, and will then draw his own picture of reality. There is clear evidence that this act of evaluating information supplied by the mass media is not a purely cognitive process inside the individual, but is crucially influenced by everyday interpersonal communication.[26]

2. The media are not just "mouthpieces" for the opinions of primary communicators, for they themselves select and, explicitly or implicitly, evaluate information by pointing, eg., to contradictions, by referring to extreme opinions as such, by recalling past errors or judgements of a primary communicator, etc. The public can thus facilitate its orientation by using the pre-assessed information of the media as a basis. On the other hand, since the media after Chernobyl themselves took different stands, the individual was faced with the question of assigning credibility to them as well.

In the present survey, time did not permit a detailed inquiry into all the aspects mentioned. The questions dealing with information on the reactor accident at Chernobyl and its consequences were confined to the credibility ascribed to 6 primary communicators

- Federal Government
- Opposition
- Nuclear Research Centres
- Ecological Institute
- Nuclear Power Industry

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[23] Where this did happen, it was often inadequate, compared to scientific knowledge. This will be demonstrated by the concomitant in-depth interviews, which are still being systematically assessed at the moment.

[24] Luhmann has convincingly shown how the allocation of trust can reduce environmental complexity and hence facilitate orientation (Luhmann, 1968).

[25] The planned second survey is to examine a simplified model for allocating credibility, containing the factors familiarity, assigned competence and presumed independence.

[26] An important role is played here by theories like the opinion leader concept employed by Katz (1952) to explain media impact. Without knowing exactly how the relationship works, it is becoming clear that the media impact cannot be considered in isolation and that the interaction of mass communication and interpersonal communication is also important. Cf. the new paper by Kepplinger/Martin (1986).

- Citizens' Action Committees

and, by way of comparison

- Journalists.

This latter group does not quite fit into the scheme of things. Nevertheless, where journalists discard their cloak of journalistic anonymity and address the public as commentators or moderators, i.e. as "institutions", they do acquire some of the qualities of a "primary communicator" like a politician or scientist.

With regard to the credibility of the media, two questions were asked about the perceived correctness and balance in television reporting. The object of these two questions was to indicate the degree of critical detachment of the public with regard to this medium. The answers should not be taken as an evaluation of television reporting itself.

Surprisingly, the credibility question did not show great differences between primary communicators (Fig. 9). Except for the nuclear power industry, which fewer than 35 % of the interviewees consider to be "completely or partly credible", all other six groups are rated between 50 % and 60 %. This means, eg., that

- citizens' action committees are believed no less than, say, the Federal Government and
- the Ecological Institute, with a staff of perhaps a few dozen and a relatively short history of research, enjoys as much confidence among the general public as the established nuclear research centres with a total staff of some 8,000.

These facts make it clear that the ecological movement has made itself respected beyond its own direct circle of supporters and finds a willing ear among many other citizens as well.

Another striking result is that the "political" actors, who have no technical competence and are particularly exposed to the reproach of being dependent on special interests, have the same credibility rating as the scientist, who should, after all, be "disinterested"[27] and competent but is obviously not seen in this way by many citizens.

The relations between the credibility ascribed to different institutions and sociodemographic features are not very marked, but significant in some cases (Table 3). They show, for example, that women generally have rather more confidence than men, that a better educational background tends to be accompanied by greater distrust as regards the Federal Government, opposition and industry, but with greater confidence in the Ecological Institute, and that the older interviewees trust the Federal Government and industry more than younger interviewees do, but they are more sceptical about the Ecological Institute and citizens' action committees.

If we examine the correlations of credibility among the seven institutions, we can identify two distinct groups, composed as follows:

1. Government, nuclear research centres and industry
2. Ecological Institute, citizens' action committees and - to a lesser extent - journalists.

The credibilities are clearly correlated with one another within each group and low between institutions in the two groups (Table 4). The "Opposition" is not definitely assigned to one group; its ascribed credibility correlates moderately with all others and most strongly with that of the Government.[28] The clear correlation between the credibility of Government and Opposition,

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27 According to a classic sociological analysis of science by R.K. Merton, "Disinterestedness" is one of the four central norms of science (Merton, 1957, p. 558).

28 The Opposition is likely to be perceived ambivalently, first of all as an established political force, and then as an institiution in opposition to the government.

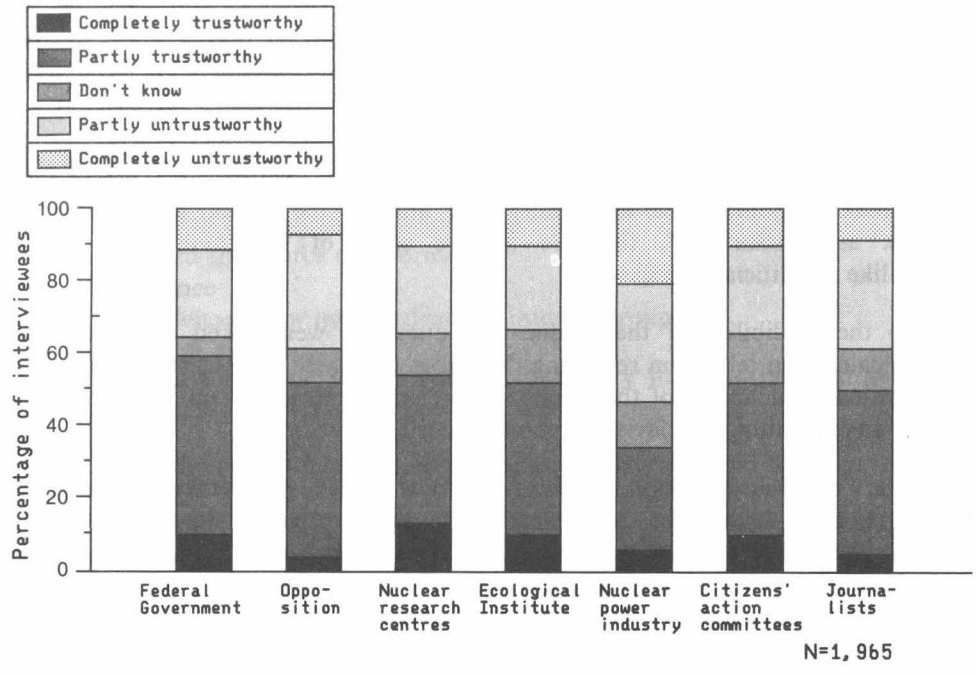

Fig. 9 Trustworthiness of information on the reactor disaster at Chernobyl and its impact on the Federal Republic

	Own children	Sex	Education	Age
Federal Government	-0.04	0.07 **	-0.10 **	0.12 **
Opposition	-0.02	0.03	-0.10 **	0.00
Nuclear research centres	-0.02	-0.03	-0.02	0.01
Ecological Institute	0.05 *	0.06 *	0.08 **	-0.13 **
Nuclear power industry	0.01	0.00	-0.08 **	0.08 **
Citizens' action committees	0.07 **	0.10 **	-0.01	-0.06 *
Journalists	0.01	0.00	0.03	-0.01

Measure: Kendall's τ_b

* significant at 5-%-level
** significant at 1-%-level

Table 3 Associations of ascribed credibility with sociodemographic criteria

however, is impressive evidence that the energy-policy controversy is difficult to locate in the traditional left versus right scheme of things.

The interpretation of these relationships is underpinned by a factor analysis of the corresponding correlation matrix, which provides an unambiguous result in the shape of two independent factors corresponding to the groups described above.[29]

[29] Statistically, the use of factor analysis is questionable on account of the supposition of a metric scale

	Federal Government	Nuclear research	Nuclear industry	Opposition	Ecological Institute	Citizens' committees	Journalists
Federal Government		0.52 **	0.51 **	0.44 **	-0.14 **	0.07 **	0.08 **
Nuclear research			0.49 **	0.24 **	-0.06 *	-0.12 **	0.02
Nuclear industry				0.23 **	-0.16 **	-0.13 **	0.07 *
Opposition					0.25 **	0.22 **	0.20 **
Ecological Institute						0.52 **	0.28 **
Citizens' committees							0.37 **
Journalists							

Measure: Kendall's τ_b

* significant at 5-%-level
** significant at 1-%-level

Table 4 Matrix of the ordinal association between the credibility of different institutions

The two factors can be typified as "credibility of the establishment" and "credibility of the anti-establishment", if we can view the Government, nuclear research centres and industry as established institutions and the Ecological Institute, citizens' action committees and journalists as tending to be institutions in opposition to the establishment.[30]

The result of this factor analysis contradicts all expectations. It means that the confidence placed in the established institutions is not highly negative in its correlation with confidence in the anti-establishment institutions. The two sectors represent independent dimensions, after all. Thus, if someone trusts the information supplied by national research centres, this does not automatically mean that he distrusts information from the Ecological Institute - nor vice versa. So we have a large number of interviewees who have confidence both in the established and in the non-established institutions.

A noteworthy fact is that the "Opposition" (certainly identified primarily with the SPD) is partly credible for both the "establishment" group and the "anti-establishment" group. The opposition is on the fence, which may, on the one hand, help explain the electoral defeats of recent months (Federal Parliament, State Parliament in Hesse), while, on the other hand, making it clear that the SPD could form a bridge between the political camps of the establishment and the anti-establishment. An earlier study also revealed an ambivalence among SPD supporters with regard to nuclear energy, whereas the followers of the CDU and the FDP, on the one hand, and the Greens, on the other, are much more homogeneous in their support or rejection of nuclear energy (Peters et.al., 1984, p. 24).

in credibility values. On the other hand, the result is so unequivocal and also in keeping with the inspection of the matrix of ordinary associations (Table 4), that it may be supposed that the statistically obtained factors are based on substantive patterns for assessing credibility.

30 In the case of the Ecological Institute and the citizens' action committees, this seems directly plausible, although it is not immediately obvious in the case of journalists. What journalists have in common with the other two institutions is that (perhaps less in practice than in their image) they critically observe and scrutinize the activities of ruling, powerful and established groups. So it would appear to be quite legitimate to include the journalists under this heading, although it must be borne in mind that this is a label not a semantic category.

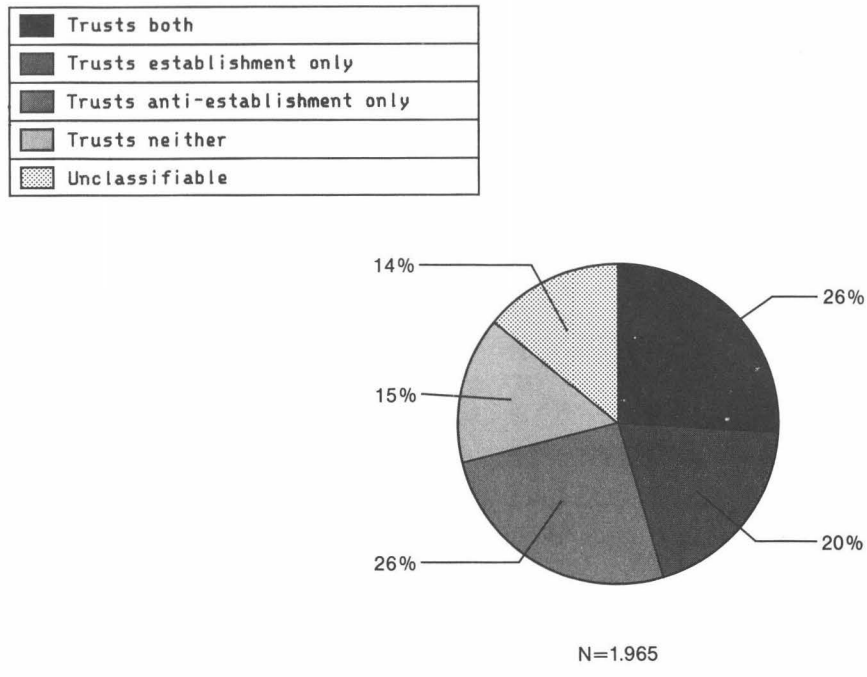

Fig. 10 Classification of population in four "confidence types"

The results of the factor analysis were used to classify the interviewees into four different "confidence-types", in line with their answers to the credibility question. For this purpose, two dichotomous indices "confidence in establishment" and "confidence in anti-establishment" were constructed[31] and cross-tabulated. Each field in the 2 * 2 matrix corresponds to one confidence type. About one quarter of the interviewees trust both the establishment and the anti-establishment; a further quarter trust only the anti-establishment; some 20 % only trust the establishment; and 15 % trust neither the establishment nor the anti-establishment. The remaining interviewees could not be classified, either for lack of figures or because of "don't know" answers (Fig. 10).

In the comparison between the credibility of the "establishment" and the "anti-establishment", it is noticeable that more of the interviewees trust the anti-establishment than the establishment (59 % as against 55 %).

The majority of the interviewees consider television reporting to be balanced. Only small groups of 12 % and 14 % respectively feel that television reports too negatively or too positively on nuclear energy, so that the Chernobyl events were overdramatized or played down (Fig. 11). In this respect, opponents of nuclear energy believe more often than the average interviewee that television is too positive in reporting on nuclear energy. This is analogously true of the supporters, who tend to feel that television reporting on nuclear energy is too negative. The corresponding correlation is $\tau_b = 0.29$ and is significant at the 1-%-level. So there is a tendency for television reporting to be experienced as being opposed to one's one opinion.

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31 The index "confidence in establishment" was calculated as a mean value from the answer codes to the questions about the credibility of the Federal Government, the nuclear research centres and the industry (with "1" for "completely trustworthy" to "4" for "completely untrustworthy") and the index "confidence in anti-establishment" has a mean value from the codes of the Ecological Institute, citizens' action committees and journalists. To take account of the fact that the credibility of journalists has a some what lower factor than that of the other two institutions, the codes of the journalists were given a weight of 0.5 in calculating the mean value. Finally, the values of both indices were dichotomized on a value of 2.5.

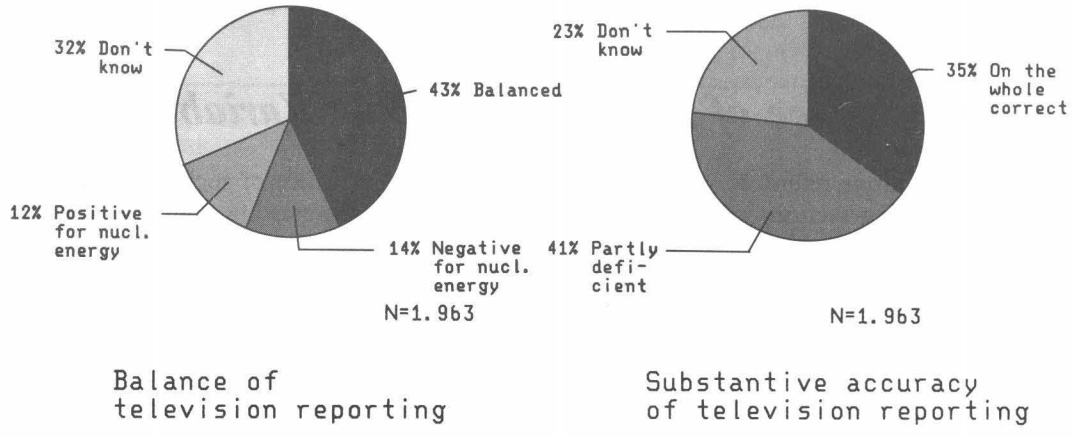

Fig. 11 Assessment of television reporting by interviewees according to balance and substantive accuracy

Such a "hostile media phenomenon" is observed on other occasions (Vallone et.al., 1985) and contradicts the view that mass media information contrary to the recipient's opinions is perceived less likely - as might be expected in view of the theory of selective perception. Thus, notice is in fact taken of information that contradicts the individual's views, although it is neutralized by various immunization strategies, eg., by casting doubt on the credibility or competence of the source concerned or by simply not accepting the paradigm within which the information is relevant at all.[32]

Also striking is the high proportion of some 43 % of the interviewees who consider television reporting to be incorrect in part at least (Fig. 11). This evaluation expresses considerable detachment from the medium (in reporting the events during and after Chernobyl). The reason for this may be found in the contradictions experienced in the reporting.

An examination of the relationship between perceived correctness of television reporting and positions on withdrawal from nuclear energy reveals a curvilinear relationship: both the supporters of more nuclear energy and the advocates of an accelerated withdrawal from nuclear energy are more critical in their assessment of the correctness of television reporting than those interviewees who are willing to tolerate the use of nuclear energy, i.e., who are neither definitely pro- nor anti-nuclear.

This result can be interpreted if we assume that people with clearly defined positions follow the media reporting less from an interest in personal information (which would make a selection of information in conformity with their own opinion probable) than in view of the supposed effects on other individuals among whom they fear an impact or manipulation contrary to their own views.

These results of a representative poll are largely in line with the experience of the in-depth interviews, in which journalists were hardly reproached with attempted manipulation but which tended

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32 An example of this last strategy can be found in one of our in-depth interviews in which an intelligent young woman, in reply to the question about the comprehensibility of information on Chernobyl, said: "No, not for me. But it doesn't have to be comprehensible in my case, though. I judge by feeling, and that's enough for me. And I find it's right that way." At another point in the same interview, the woman remarked that she could not talk very easily about Chernobyl to her husband, since "for me he was not hysterical enough about this business and not sensitive enough," although he, too, was a confirmed advocate of a withdrawal from nuclear energy. The paradigm of "rationality" within which information about technical or biological facts only makes any sense at all is explicitly rejected here in favour of the paradigm of "emotionality".

to challenge their competence. Thus, the deficits in the reporting on Chernobyl are, to most television viewers, not so much an "ideology" problem as a competence problem.

3.5 The Influence of Sociodemographic Variables

In the last two sections reference was repeatedly made to the influence of sociodemographic variables. The following section considers some of the particularly interesting points once again in context.

Sex-specific differences in the perception and assessment of nuclear energy, such as have been observed again and again in empirical studies, can be shown in the present data as well: women are more critical of nuclear energy than men (Table 2). This correlation holds true when we check the educational background and is found in all age groups.

Charles J. Brody, on the basis of a secondary analysis of two American surveys on nuclear energy in the years 1975 and 1976, comes to the conclusion that the main reason for this sex-specific difference in opinions is to be found in the greater stress laid by women on safety aspects. The likewise conceivable hypothesis, that the different assessments given by men and women are due to differences in the perception of economic advantages, is one that he rejects (Brody, 1984). However, his argumentation on the irrevelance of economic aspects to explain sex-specific differences is not conclusive so that this question must remain open for the time being.[33]

One surprise is the result of only a slight statistical association between the presence of small children in the family and the perceived threat from environmental pollution in general and from the reactor disaster at Chernobyl in particular, as well as the corresponding consequences for nutrition and the withdrawal from nuclear energy (Table 2). Now, the presence of small children is strongly correlated with other sociodemographic variables like age, education and sex (more single mothers than fathers). As a result, corresponding relations may easily be modified by these intervening variables, so that a statistical control of possible intervening variables is necessary. Technically, this is done by using multivariate procedures and, in the present case of largely categorial data, by means of logistic regression.[34] The following dichotomized survey variables were used (successively) as dependent variables:

- Nuclear energy risk compared with the USSR (less, greater or the same)
- Perception of damage to personal health (no/yes)
- Change in personal eating habits (no/yes)
- Position on use of nuclear energy (further use/accelerated withdrawal)

Four sociodemographic features were used as independent variables:

- own children (no/yes)
- sex (male/female)

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[33] In his argumentation, Brody proceeds in two steps. First of all, he proves that men and women differ in their perception of safety aspects, but not in their perception of economic aspects. He rightly assumes that this does not yet prove the relevance of such differences for the different attitudes to nuclear energy and, in a log-linear model containing the three variables "general nuclear attitude", "sex" and "perceived safety", shows that the relation between "sex" and "general nuclear attitude" is explained by the "perceived safety". In the process, however, he overlooks the fact that this is only true within the selected basic model and neglects to specify an extended model containing the "perceived economic advantages" as well. Even if there are no sex-specific differences in the mean evaluation of the economic advantages and drawbacks of nuclear energy, the correlation between the perception of these advantages and drawbacks and attitudes to nuclear energy may nevertheless be subject to sex-specific explanation.

[34] For a precise description of the general linear model underlying this procedure, see, eg., Arminger (1983) and Baker/Nelder (1978). On the multivariate analysis of non- metric data in general, Küchler (1979) can be recommended.

	Men		Women	
	without children	with children	without children	with children
Nuclear energy risk compared with UdSSR	0.00	-0.11	0.50	0.99 *
Perception of damage to personal health	0.00	-0.38	-0.28	0.28 *
Change in personal diet	0.00	-0.07	0.52	1.04 *
Position on use of nuclear energy	0.00	-0.59 *	0.40	0.53

Parameter estimates of a logistic model; all values - with a statistical control of age and education - are to be interpreted relative to the reference category of men without children: positive values mean higher estimates of risks and more frequent consequences than in the reference group, while negative values indicate the contrary

* Difference significant at 5-%-level

Table 5 Influence of children on perception and assessment of the Chernobyl events

- age (6 age groups)
- education (6 ordinal categories)

The object of the analysis was to determine the relationship between sex and the presence of small children and the dependent variables, with a statistical control of age and education. For this purpose, model equations were formulated in such a way that they contained the main effects of age, education, children and sex, the interaction effects of age and education and of children and sex.[35] The main and interaction effects of age and education are represented in the model only to obtain a statistical control of the effects of the variables children and sex with regard to the first two variables named, so that their content is not the subject of further interpretation in the present study.

The parameter estimates of the model are astonishing (Table 5). Indeed, controlling for age and education does not alter the sex-specific difference in the perception and assessment of the events at Chernobyl that women rate the risk higher than men do, so that they change their eating habits more often and are also more in favour of a withdrawal from nuclear energy. Only one single parameter value, viz. the assessment of the effects on health given by women without children, does not fit into the picture, although we have no ready explanation for this.

However surprising are the results of the comparison between interviewees with and without small children. While the existence of small children has the expected effects among women, viz. that the consequences of Chernobyl are given a more serious assessment, the contrary is the case for men with small children. Men with small children tend to take a more casual view of the consequences of Chernobyl then men without small children. The existence of this converse correlation between the existence of children and the assessment of the consequences of Chernobyl among men and women explains why the overall figures revealed only a slight effect produced by the existence of children: the definite correlation between the existence of small children and the assessment of the consequences of Chernobyl among women is partly compensated by an altogether weaker correlation, the other way round, among men. These effects are more or less on the margin of statistical significance. On the other hand, the high consistency of these results between different variables suggest that it is unlikely that these facts have no substantive causes.

35 As formulated in the GLIM statistical analysis program employed, (Baker/Nelder, 1978): AGE*EDUCATION + CHILDREN*SEX

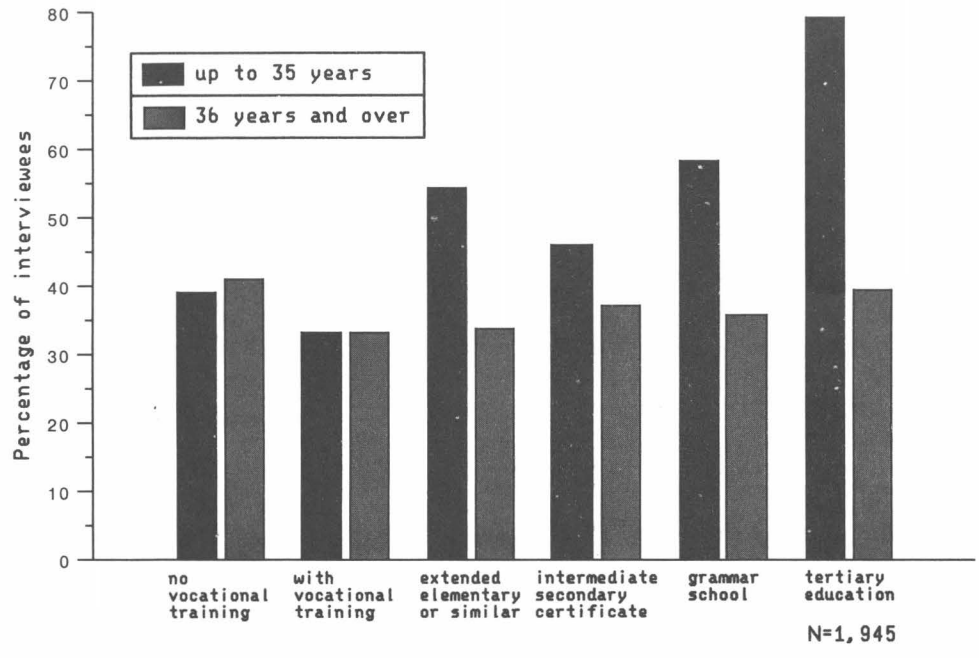

Fig. 12 Advocates of "stepping up" withdrawal from nuclear energy as a function of education, for younger and older interviewees

The correlation between the position taken by the interviewees on the future use of nuclear energy and their educational background - taking a global view - is very slight ($\tau_b = 0.03$, cf. Table 2). However, a closer look shows that there is a considerable divergence between younger and older interviewees (Fig. 12).

Among younger interviewees (younger than 35 years) there is a definite positive relationship with education: the better the educational background, the more probable it is that the interviewee is in favour of a withdrawal from nuclear energy ($\tau_b = 0.18$). The perfect picture of a monotonic relationship is impaired merely by the group "senior secondary education without school leaving certificate", which act like the group "with university matriculation certificate" and by the lowest educational group, which is rather more critical in its views on nuclear energy, among both the younger and the older members, than the interviewees "with apprenticeship".

In the case of the group "senior secondary education without school leaving certificate", the younger interviewees are likely to be students still attending grammar school and not drop-outs as in the case of the older interviewees. It is not implausible that these students will reply like the grammar school leavers. So the classification of these interviewees in a category between people "with apprenticeship" and interviewees "with intermediate secondary school certificate" is rather doubtful. On the other hand, there is no obvious explanation for the rise in mean rejection encountered in the lowest educational group. However, the difference between this and the next group is very small and not significant.

There is no pronounced relationship ($\tau_b = 0.02$) between educational levels and the rejection of nuclear energy among older interviewees (> 35) so that education as a predictor of attitudes to nuclear energy is only of importance in the case of younger interviewees.

The differences between older and younger interviewees with regard to their position on nuclear energy is much more pronounced at higher than at lower educational levels. One possible explanation is that the interviewees with lower educational levels and a correspondingly shorter period of school attendance are much more thoroughly socialized in class-specific generation-spanning social networks than interviewees with a higher educational background and a longer

	Nuclear energy risk compared with USSR	Perception of damage to personal health	Change in personal diet	Position on use of nuclear energy
General environmental sensitivity	0.24 **	0.25 **	0.12 **	0.26 **
Nuclear energy risk compared with UdSSR		0.22 **	0.09 **	0.34 **
Perception of damage to personal health			0.22 **	0.27 **
Change in personal diet				0.21 **

Measure: Kendall's τ_b ** significant at 1-%-level

Table 6 Interrelationships of some substantive variables

period of attending school, whose political socialization will have been determined to a greater extent by school and university. If we assume the proposition that extensive changes have taken place there since the sixties both in the curricula and in the social climate of school and student networks, this might go some way to explain the great difference in assessing nuclear energy.

3.6 Interdepencence of Substantive Variables

As expected, the variables

- General environmental sensitivity
- Nuclear energy risk compared with the USSR
- Perception of damage to personal health
- Changes in personal eating habits
- Position on use of nuclear energy

are more or less strongly correlated (Table 6). The best predictor of advocacy of withdrawal from nuclear energy is the evaluation of the risk of an accident in West Germany similar to that at Chernobyl. So it is not so much the belief that the consequences of Chernobyl are not so serious after all as the view that German nuclear power stations are safer than Russian plants that make a large number of interviewees favour or at least tolerate the further use of nuclear energy. On top of this, we may have the argument that, if Germany goes alone in withdrawing from nuclear energy, this would bring little in the way of safety, in view of the extent of the risk and the proximity of many nuclear power stations to the German border, but would involve considerable economic drawbacks.[36]

The "change in eating habits" correlates most strongly with the perception of damage to personal health, which is indeed plausible. Those who do not believe in any grave threat to their health from the radiological impact of Chernobyl are less likely to change their eating habits. Still, the converse is also conceivable: those for whom the change in eating habits is a nuisance or not possible, because they eat in the factory canteen, for example, talk themselves into believing that the health risks are not so great after all.

36 This argumentation pattern occurred often in the accompanying in-depth interviews.

4 Interpretations and Political Implications

4.1 Social and Psychological Consequences of Chernobyl

The events at Chernobyl have very different effects on different people. Convinced advocates and opponents of nuclear energy are unlikely to have changed their minds. Opponents of nuclear energy felt confirmed in their views. They can point out that they foresaw such an accident. They feel that withdrawal from nuclear energy is possible without serious economic consequences, or that the step should be taken even at the price of lower living standards. As alternatives to nuclear energy, they refer, first of all, to regenerative energy sources and energy saving, and, secondly, to coal, which should be used in power stations that are as environmentally safe as possible.

The convinced advocates of nuclear energy, on the other hand, felt the head wind of public opinion and, although this prevented them from aggressively arguing their case[37], they seldom changed their minds. A number of cognitive strategies are employed by this group to deprive the event of its relevance for their own opinion[38]:

- They point out that Russion nuclear power stations for various reasons (inter alia for reasons associated with the authoritarian political system) are much less safe than German power stations.
- They stress that, if Germany were to go it alone in withdrawing from nuclear energy, this would entail hardly any gain in safety, but would involve considerable economic and competitive drawbacks.
- They point to the energy needs that must be covered and for which nuclear energy is indispensable.
- The risk to health from fallout following the Chernobyl accident is disputed.
- Finally, they postulate a link between nuclear energy and "progress", summed up in a statement like: we can't go back to the Stone Age.

The convinced advocates of nuclear energy, on the one hand, feel that exaggerated accounts were given in the West German media of the consequences of the reactor disaster, but are prepared, on the other hand, to accept a certain risk as the price for the advantages brought by nuclear energy.

Of course, most of the population is not made up of convinced advocates or opponents of nuclear energy, but of people with an ambivalent attitude toward nuclear energy. The perceived risks associated with nuclear energy are contrasted with perceived economic advantages which people do not want to do without. This group is open to information on the risks involved in nuclear energy, such as became clear in the Chernobyl disaster, and employs no conciliatory strategies, as the convinced advocates of nuclear energy do, in order to play down the scale of the disaster. An increase in the perceived risk associated with nuclear energy, although the perceived utility remains the same, will lead to a worsening in the cost-benefit ratio for nuclear energy. This is reflected in the increase mentioned in the number of those in favour of withdrawing from nuclear energy. In

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37 On the interpretation of "public opinion" as a sanction norm for public communicative action, cf. Noelle-Neumann (1980, p. 91ff.) and Peters (1984, pp. 41-43).

38 The analysis of the in-depth interviews now in progress will throw more light on these questions.

view of their inconsistent belief structure, on the other hand, this group is also open to a further revision of its attitude to nuclear energy. The extent to which this actually occurs, eg. as the events at Chernobyl recede into the past and the memory fades, will be shown by the scheduled repeats of the representative survey.

The relative weight of the economic and the risk-related considerations associated with nuclear energy is dependent on a number of factors which, in their interaction, give rise to complex relationships between the position on nuclear energy and sociodemographic variables. These factors include:

1. Socialization conditions during certain critical phases in early youth that depend on the structure of values of the time (Inglehart), on upbringing in the family and the type of education or vocational training.

2. Phases within the life cycle associated, say, with the responsiblilty (in financial and health questions) for one's children.

3. Nature of one's profession and position in the professional hierarchy, involving, say, responsibility for the continuation and profit of a firm or activity like that of a teacher in charge of dependent persons

4. Sex-specific roles, which can be more or less pronounced and may have an impact, eg., on the division of labour between man and woman inside the family (responsibility for earning a living, as against responsibility for the physical and psychological welfare of children).

5. Loyalties to institutions like, eg., political parties, trade unions, churches, etc., which have themselves formulated and published more or less definite positions on nuclear energy for the orientation of their members.

These five fundamental factors, which probably go far to determine the perception and evaluation of the events at Chernobyl, correlate with sociodemographic variables like age, sex, education levels, existence of small children, etc., and, in this way, create the complex picture we have of non-monotonic relations and interaction effects in which it is difficult to identify causal factors.

4.2 The Polarization of Science

The fact that only 54 % of the population trusted the information from national nuclear research centres after Chernobyl is only at first sight surprising. According to a well-known dictum of Karl Marx, "being" determines "consciousness". So organizations like the nuclear research centres which owe their foundation and continued existence to developments in nuclear energy are always open to suspicion that their statements on nuclear energy reflect not simply the truth of scientific effort but also tactical considerations to safeguard their own survival. This was no problem as long as nuclear energy was widely accepted or while opposition was confined to a small radical group. As our study shows, the credibility problem for nuclear research has now affected wide sections of the population. "He who pays the piper, calls the tune" is one of the heuristics used by people to describe the credibility issue.

So-called "alternative" scientific facilities like the Öko-Institut (Ecological Institute) in Freiburg or the Institute for Energy and Environment (IFEU) in Heidelberg have evolved in the minds of the public into a counterbalance to the "established " research centres, so that they have virtually the same status and their statements enjoy hardly any less credibility than those of the nuclear research centres. This development is not to be explained by an inability on the part of the public to differentiate, so that people simply lump together anybody and everybody who give themselves a scientific veneer by adopting a title or an institutional name, since the credibility of nuclear research facilities is challenged in particular by people with good educational backgrounds. Even those citizens who consider the statements of "alternative" scientists to be exaggerated are in favour of the existence of such facilities. Above all, the role of such alternative institutes as a "warning system" has now gained wide acceptance.

The polarization of science in an "established" and an "alternative" wing raises questions as to the functioning of the scientific system, whose overriding criterion should be that of "truth" and not that of "political impact" (Luhmann, 1986, p. 150ff.). The present survey does not produce any direct proposals for action to deal with science's loss of credibility. What does become clear is that simply ignoring this problem is, in the long run, dysfunctional both for science itself and for the potential contribution it can make towards solving societal problems.

Established research facilities' strategy of ignoring so-called alternative research has not prevented such research being regarded as credible by a large section of the public and has not stopped such facilities receiving research contracts from even a CDU government.[39] The fact that an "alternative" science is recognized by the public and by political institutions implicitly challenges the universalist claims of "established" science.

There is no simple solution to this problem. The inroads made by politics in science as a consequence of the inroads made by science in politics (Peter Weingart) cannot be stopped. On the other hand, it is worth considering, in research areas of such relevance to politics as energy and environmental research, how we might institutionalize cooperation and dispute between scientists to ensure that the primary issue is not so much the political impact of scientific statements but their "truth".

Steps in this direction are the Select Committees (Enquete-Kommissionen) of the German Bundestag set up in recent years to help create an "arena" for scientific controversies with a political dimension. The institutionalization of working groups dealing with clearly defined issues and crossing the borderline between the two scientific "camps", instead of the practice of producing "expert reports" and "alternative expert reports", might be a further strategy to diminish the polarization of science. Joint project groups at a working level are much more efficient ways to submit scientific arguments in the case of differences of opinion than public hearings and panel discussions - the form that most disputes between "established" and "alternative" scientists take today.

A further strategy for depolarizing the scientific landscape would involve stressing the pluralism of scientific positions within each camp. Much more problematical than the existence of divergent views among scientists, which is after all the rule rather than the exception, is the perceived congruence of the membership in certain scientific organizations and the stances adopted there, giving rise to stereotypes which do not reflect the variety of opinions within both the "established" and the "alternative" camps.

Finally, ways might be found of relaxing the close association of certain scientific organizations (like the nuclear research centres) with industry, which dates back to the early days of nuclear energy. In view of this interlocking of interests - certainly over rather than underrated by the general public - the nuclear research centres suffer from the industry's poor image. Statements made by scientists on, say, the advantages of nuclear energy are only credible to the public if it cannot be ruled out a priori that these scientists could also hold an opposite view, and would not have to reckon with sanctions for doing so.

The present policy pursued by the Federal Ministry of Research and Technology tends to aim at a contrary strategy, viz. even closer association between national large-scale research facilities and industry, in order to step up the process of economic innovation. But such a policy ignores the repercussions of increasing industrial cooperation on science itself, which is facing ever greater legitimation problems in its contacts with the general public, wherever controversial technologies have to be developed (which is often only appreciated after the event, as in the case of nuclear energy).

A loss of image for certain sections of the scientific community can have grave consequences. The view that, as long as state finance is assured, science can be indifferent to public opinion, is very

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[39] A recent example of this practice is the commissioning of an report from the Ecological Institute by the Federal Economics Ministry on withdrawal from nuclear energy.

dangerous. In the first place, the public financing of controversial research in a democracy is under pressure to provide justification and is, potentially at least, in jeopardy. Secondly, a bad image has disastrous consequences for the recruiting of a new generation of scientists. The inclination to take up certain activities is not hereditary, but evolves in the course of a socialization process in which many factors, like career opportunities (labour market), working conditions (self-determination), potential earnings, access to influence and power, and public recognition as well, all play a role. The fact that scientists earn more money in industry is no accident, but some compensation for their having to go without many privileges enjoyed by academic scientists - with comparable qualifications - and for their lower esteem in the public eye.

4.3 Orientation in a State of Uncertainty

The results of the survey indicate great uncertainty with regard to the evaluation of the consequences and the precautionary measures to be taken. A majority of the interviewees seem to be unable, faced with the events at Chernobyl, to find a consistent and reliable orientation for their own actions.

Of course, the reactor accident at Chernobyl does mean a massive disruption in the orientation system for everyday action. Certain aspects of daily life, taken for granted and seldom subject to scrutiny, like diet, personal health, the innocuousness of natural environment, combine to form the unchallenged basis of everyday activities. Only where this basis need not always be called in question can it produce any certainty for our daily activities.

This background of everyday behaviour was challenged by Chernobyl. The now widespread knowledge of the danger that radioactivity poses to personal health and the knowledge of the release of radioactive substances during the reactor accident called for a reorientation in our activity and generated uncertainty and even fear, to start with.

In this situation, the individual was largely dependent on the assessment of the situation given by third parties - by experts and by political and administrative agencies. However, in view of the highly contradictory interpretations of the situation given even at the scientific level of reality, on which both citizens and politicians were ultimately dependent, it was not possible to offer any definite orientation for action here either. Thus, uncertainty can be regarded as an objectively rational and appropriate response to any situation that has a risk potential for the citizens which cannot be defined with absolute reliability.

The situation became even more unmanageable for the individual, however, due to an information policy on the part of the political and administrative system which made some critics speak of Chernobyl as being primarily an "information disaster".

Of course, the to and fro between offical anouncements to the effect that health risks could be ruled out for the Federal Republic of Germany and other relatively far-reaching recommendations for action, coupled with contradictions in the measured values and limits, or information supplied on the effects of very low radiation on health, etc, cannot be blamed on the political and administrative system alone; as was said earlier, this has its roots in the expert's level of perception. To this extent, uncertainty cannot be ruled out even by the governmental crisis management, unless there is a monopoly of information at one government agency (eg., the Department of the Environment), but that would offend against democratic norms, and would be difficult to implement anyhow, since, where there is a free press, there are always other sources in addition to the government that are able to provide what may be contrary information.

Nevertheless, going beyond this state of information, which the political and administrative system cannot remedy, the state's crisis management made its own contribution toward unnerving the population, since the government obviously did not succeed in creating an adequate level of confidence about its ability to act amongst the public. Although the survey results show that, of all the institutions presented for an evaluation, the Federal Government was awarded the most points for credibility, we are still left with some 40 % of the interviewees who feel that the infor-

mation published by the Federal Government following the disaster at Chernobyl was untrustworthy, either wholly or in part. For this group of interviewees, at least, the feeling of uncertainty produced by the reactor accident was not compensated by confidence in the reliability and competence of the state's crisis management. Even for a large number of the citizens who themselves said that they had substantial confidence in the information supplied by the Federal Government after Chernobyl, this evidently reflects only one aspect of the truth. Otherwise, it would be hard to explain why such a large proportion placed their confidence not only in the established, but in the non-established institutions as well.

Political crisis management can draw its legitimation mainly from the principle of providing "collective care", which in the case of Chernobyl implies steps to minimize the risk to the health of the individual citizen. In addition, crisis management, like any acts taken by the state, must satisfy the principle of "transparency" in order to enable a democratic control of the decision-making process. After Chernobyl, therefore, citizens should be able to expect government agencies to give a full account of the information underlying the decision-taking process. In this respect, at least part of the population was disappointed.

Moreover, it must be assumed that the confidence of the general public in the political system was already strained by the very fact that a "super-MCA" seemed to "refute" the information policy pursued until then by government agencies, which - underpinned by probabilistic risk studies - had always dismissed disasters on the Chernobyl scale as merely hypothetical. In the controversy conducted in society prior to the reactor accident at Chernobyl on the risks involved in nuclear energy, the unbiased observer might well have been given the impression that an accident like that at Chernobyl was a virtual impossiblity. Certainly with one eye on the general acceptance of nuclear energy, there was simply no discussion of the fact that the high safety standards applicable to nuclear power stations in the Federal Republic, on which the risk studies were based justifying the use of nuclear energy, were not satisfied by many foreign nuclear power stations, and that a reactor accident occurring outside West Germany might have an impact on the Federal Republic as well.

The lack of differentiation in statements on the safety of nuclear power stations, seen in the practice of generalizing the results of studies devoted to specific nuclear power stations and extending them by an improper and uncontradicted process of popularization to apply to the safety of nuclear energy as a whole, was now held against nuclear energy as such after the catastrophe at Chernobyl. The public reversed the process and inferred the danger of nuclear energy as such from the proved danger of one specific reactor type.

A "measure to create confidence" following Chernobyl would have to have involved an information policy unreservedly oriented to the principle of "transparency" and publishing even contradictory scientific reports on the implications to be expected for the Federal Republic, while describing these contradictions as being incapable of solution at the level of political crisis management. Utterances like that of the Minister for the Interior Zimmermann, who claimed, as soon as the accident became known and even before detailed information was available, that there was no risk at all for the population of the Federal Republic, could not fail to arouse the citizen's suspicion that this crisis management was aimed less at the goal of collective care than at the goal of reassuring the population, so that the policy was being used less to inform the public than as a palliative.[40]

The individual citizen's need to find some orientation in his state of uncertainty, caused by the contradictory information at his disposal and the lack of subjectively trustworthy sources of information, made it seem plausible for the citizen to employ information-aggregating heuristic mechanisms derived from everyday experience and used as interpretative patterns controlling his own information process, which he now applied to an involved and unfamiliar situation. The in-depth interviews revealed three different heuristic mechanisms of information aggregation and evaluation, which can be formulated as follows:

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[40] Comparable, say, with the "information policy" of the pharmacist mentioned in the footnote no. 42.

1. "We're only getting the tip of the iceberg. The actual situation is sure to be much worse"
2. "The whole thing is being exaggerated. There is hardly any real risk."
3. "Some say this, and some say that. The truth is bound to be somewhere in the middle".

Unfortunately, the present surveys do not enable us to quantify the extent to which these three mechanisms played a role in assessing information. The most frequent position is likely to have been the third, however, i.e., a sort of weighted mean value was formed, with the weight probably depending on the relative credibility of the source of information and the risk orientation of the person concerned.

4.4 Efficacy of Regulation Styles

Even though we can assume that the primary goal of crisis management in the Federal Republic was a reduction in the direct consequences for the population's health, account must be taken of the fact that the political institutions concerned with regulation were confronted with various conflicting goals which, depending on the political position held, made it politically opportune to overdramatize or play down the consequences of Chernobyl:

- The information and the action recommended influence the fear felt by the population and, hence public opinion regarding nuclear energy. In this way, the pressure of public opinion might give rise to a modification of energy policy. Those institutions with a positive view of nuclear energy will then tend to play down the implications, whereas those who are opposed to nuclear energy have an interest in dramatizing the impact.
- Those institutions involved in informing the public on the events in Chernobyl will make attempts to present themselves as particularly competent and aware of their responsibilities in tackling the consequences, which will tend to mean recommending particularly thoroughgoing measures.
- The more far-reaching the recommended measures are, the more serious will their economic side effects be (eg., on account of not selling food declared to be unfit for human consumption). Faced with potential claims for damages, those government agencies from whose budget any claims for damages would have to be satisfied will be particularly restrictive in adopting recommendations which may involve financial losses.

In addition to the primary goal of protecting the population against radiological contamination, the above considerations will influence the information and other policies of the regulating institutions. The population is also aware of this. That is why any regulatory policy must deal with the suspicion of its being dependent on particular interests if the credibility of the regulating agencies is to be maintained and if voluntary measures are to be followed.

One basic problem that seriously impedes a regulatory policy is the plurality of

1. Risk orientations (degree of risk aversion) and
2. Information needs and the ability to process information

in the population. In fact, a different information policy would be necessary for different population groups. While mere recommendations are sufficient and comprehensible to one group, and any additional information would only tend to add to the confusion and jeopardize the recommendations, completely different information needs are encountered in groups with a better educational background and among people who feel particularly affected. In such cases, there is a desire to form one's own picture of the radiological contamination and - since inferences and recommendations always contain a subjective element, after all - to draw one's own conclusions from this information and at least appreciate how these recommendations came into being. In this group, the publication of recommendations without appropriate background information would immediately arouse the suspicion that the situation is being played down.

In threatening events like Chernobyl, therefore, the government's information policy always represents a balancing act between the abysses of perplexity and confusion in the population, on

the one hand, and the loss of credibility, on the other. The more the information from state agencies is regimented, coordinated and centralized, the less will be the contradictions in the government's information, but the greater will be the distrust of the population, who may feel that relevant information is being concealed. Since government authorities, as the present study has shown, do not have a monopoly in credibility, a reduction in the contradictions of information supplied by the state would hardly diminish the confusion for the citizen, and suspicions about public information policy might even increase.

The Federal Government's idea that information for the public should in future be centralized, as is envisaged in the Radiation Protection Precautions Act passed in January 1987, tackles only one source of uncertainty: the contradiction in information, while on the other hand encouraging misgivings about this source of information and undermining its credibility. Credibility in the face of an event like Chernobyl will only be maintained if everything is avoided that might look like suppressing or withholding information - even at the price of inconsistencies in the information supplied.

The experience from the in-depth surveys is that many citizens are definitely in a position to cope with inconsistencies since they have to do this every day anyhow in a democracy with a free press. Viewed from this angle, the planned measure to centralize information must be regarded as highly questionable.[41]

The reasons just given make it clear that there can be no perfect information policy. In selecting the relatively "optimum" information policy we must consider the following aspects:

- Transparancy and frankness (no concealing of even apparently menacing facts)
- No hasty "a priori" judgements that have to be revised at a later date.
- Discussion of the causes of differing judgements and existing uncertainty.
- Recommendation of a graduated range of precautionary measures, to be followed to a greater or lesser degree, depending on individual needs.[42]

The striking dependence of changes in nutritional patterns on educational background, as described earlier, makes it clear that a regulatory policy based primarily on voluntary recommendations gives rise to considerable class-specific inequalities in the spread of the risk in the population. The available data should not be naively interpreted as a measure of actual changes in diet but as a cognitive stance, as a willingness to take such steps. There may be numerous hurdles between the decision and its implementation, starting with the non-availability of alternatives (powdered milk, for example, was sold out in many places) up to time pressures which can vitiate good intentions when it comes to shopping. Many of the interviewees will have been induced by public opinion to make a verbal starement asserting a change in nutritional patterns, but will in reality have retained their old eating habits, either from complacency or from the lack of a subjective feeling of being threatened - and it is quite plausible to assume that a corresponding "climate of opinion" will be perceived with greater intensity the higher up the educational scale we go. On the other hand, many of the interviewees who stated that they retained their old diet will in fact have been compelled to change their nutritional patterns owing to the

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41 The second survey series provides for a question on this complex, dealing with the preferences of the population with regard to a pluralist but contradictory, against a central information policy.

42 Various studies examining how stress is dealt with make it clear that the experience of helpnessless is one of the greatest stress factors. Such helplessness was mentioned by several interviewees in the in-depth interviews; in most cases, this was linked with a feeling of resignation. Thus, the indication of the possibility for action may have the effect of relieving tension and can reduce the stress level. A pharmacist, asked on the behaviour of his customers, said that he had sold his customers an iodine preparation when requested. It contained iodine in such small quantities that it could have no harmful side-effects - although it would have no radioactive protection effects either. He justified this action by mentioning the "psychological impact" on the customers. This does of course raise considerable ethical problems as to how far it is justifiable to use false arguments and lull people into a feeling of (perhaps justifiable) security.

shortage of fresh milk, outdoor salad and so on in many retail stores - in many cases, without their being aware of the change.

Nevertheless, should such cases arise in future and a decision have to be taken between "voluntary" nutrition at recommendations and governmental measures, eg., confiscating or prohibiting the sale of contaminated food, it must be borne in mind that the less sweeping measures will not be heeded by wide sections of the community, so that considerable class-specific disparities will arise. The present study shows that this is true not just of the population as a whole but of specific risk groups like small children.

5 Summary and Further Outlook

A representative survey of just under 2,000 citizens of the Federal Republic of Germany some seven months after the dramatic events at the Russian nuclear power station of Chernobyl demonstrates that the incident has left considerable sections of the population with a feeling of uncertainty as to the effects on their health. Surprisingly, about one half of the interviewees stated that they had altered either their own or their children's diets following the event. The changes actually noted are closely connected with the educational background of the interviewees, this probably being due, on the one hand, to the fact that (mainly in the group up to age 35) educated people tend in general to be more critical about nuclear energy than the less educated and, on the other hand, to the circumstance that the translation of opinions and attitudes into practical decisions and action will presumably be more rapid and systematic among people with a higher education.

Some 40 % of the interviewees were shown by the poll to be in favour of an accelerated withdrawal from nuclear energy, i.e., by shutting down existing nuclear power stations and not only by stopping the construction of new reactors. Although a corresponding question had not been asked before the reactor accident, so that a genuine before-and-after comparison is not possible, it is likely that the Chernobyl accident has greatly increased the ranks of anti-nuclear groups. Interestingly enough, it is not the youngest interviewees who are most opposed to nuclear energy, but the group of 25 to 30 year-olds.

The perception and evaluation of the events at Chernobyl is interindividually dependent on a very highly differentiated function involving generation, phase of life and situation as well as sex role, which gives rise to a very complex system of interrelationships between the assessment of the events and sociodemographic variables.

As for the confidence placed in the institutions which provided the public with information following the accident at Chernobyl, there are two surprises. First of all, the confidence in "established" institutions like the Federal Government, nuclear research centres and the nuclear industry is hardly any greater than the confidence placed in institutions like the Ecological Institute, citizens' action committees and journalists opposed to the establishment. Secondly - and against all expectations - there is hardly any negative correlation between confidence in the "establishment" and confidence in the "anti-establishment". Approximately one quarter of the population more or less trust both camps; some 15 % trust neither. The single institution enjoying the highest credibility is the Federal Government; that enjoying the least credibility by far is the nuclear industry.

Proceeding from some striking results of these surveys, there was a discussion of how the political implications of the observed response of society to the Chernobyl events might affect science policy and the design of a regulatory and information policy in situations like that after Chernobyl.

This makes it clear that if the credibility of the governmental information policy is to be maintained, it is necessary to identify the sources of uncertainty and contradiction. In a muddle of information which is experienced by everybody and which cannot be avoided by any government in a pluralist society, streamlined information presented with dogmatic claims as to its truth will hardly become an anchor for orientation and will tend to arouse misgivings about the reliability of information supplied by the government.

The present represensative opinion poll leaves some important questions as to the perception and evaluation of events at Chernobyl unanswered, and many new questions are raised by the results. A follow-up of the representative surveys, and the analysis of the in-depth interviews already carried out, will provide further insights into the response of the population.

The area of institutional response has been largely ignored so far in our studies. To this extent, the present report is no more than an interim report as part of a comprehensive project to analyze the reactions of society to the events at Chernobyl. Further project stages will deal with the roles of scientific bodies, governmental institutions, parliamentary and extra-parliamentary political groups in the political response to the reactor disaster. Also envisaged is an examination of the function of the mass media in transferring the information on the reactor accident in the Soviet Union and its impact on the Federal Republic of Germany.

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Appendix: Questions and Distribution of Answers

Question 1: General environmental sensitivity

Much is said and written today about envionmental pollution and its effects on our health.
I'll read out a few opinions. Tell me whether you agree with these opinions or not.

Read the statements aloud

	agree %	disagree %	Σ %	N
Present-day life expectancy, i.e., the fact that people now live longer than they used to do, shows that pollution has no serious impact on health	19.3	80.7	100.0	1,954
Although pollution does involve a risk to health, this can be restricted by taking proper action	72.1	27.9	100.0	1,955
Illnesses caused by pollution represent one of the gravest threats today, and medicine is hardly able to protect us	72.1	27.9	100.0	1,950

Question 2: Position on use of nuclear energy

Different views can be held on the use of nuclear energy to generate electricity. Using the following list, tell me which opinion you would agree with.

Present list G2
Only one anwer possible

	%
We should use as much nuclear energy as possible and build further nuclear power stations if necessary	7.2
We should maintain the present level of using nuclear energy and only build new nuclear power stations if older plants are shut down	21.4
We should use nuclear power stations already in operation or under construction until the end of their lives, but not build any new plants	31.2
We should shut down our nuclear power stations in the course of the next few years and dispense entirely with the use of nuclear energy	30.9
We should shut down all our nuclear power stations at once	9.3
	100.0 (N = 1,953)

Question 3: Presumable cause of the reactor disaster

What in your opinion was the chief cause of the reactor disaster at Chernobyl:

- Human error
- or technical failure
- or did both play a role?

	%
human error	9.1
technical failure	8.9
both played a role	72.5
don't know	9.4
	100.0 (N = 1,963)

Question 4: Risk of nuclear energy compared with the USSR

Opinions differ as to whether the nuclear power stations in the Federal Republic are safer that those in the Soviet Union.

What is your view? Is the risk of a disaster in German nuclear power stations -
- much less,
- rather less,
- just as less
- or higher than in Russian nuclear power stations?

	%
much less	27.5
rather less	34.4
just as high	26.9
higher	1.0
don't know	10.1
	100.0
	(N = 1,963)

Question 5: Presumable number of casualties in the Federal Republic

The increases in radioactivity following the Chernobyl disaster may give rise to cancer and cause further casualties in the years to come.

In your view how many people in all will die in the Federal Republic as a result of the Chernobyl accident?

Present list G3

	%
nobody	13.1
less than 10	5.1
10 - 100	6.7
100 - 1,000	11.3
1,000 - 10,000	9.3
10,000 - 100,000	4.3
over 100,000	2.8
don't know	47.4
	100.0
	(N = 1,953)

Question 6: Presumable number of casualties in the USSR

An how many in the Soviet Union?

Present List G4

	%
less than 10	0.2
10 - 100	3.4
100 - 1,000	8.9
1,000 - 10,000	19.2
10,000 - 100,000	17.8
over 100,000	14.4
don't know	36.1
	100.0
	(N = 1,957)

Question 7: Changes in personal diet

Did you change your diet after the reactor disaster at Chernobyl in order to minimize the radiactivity in your food?

	%
yes	44.9
no	55.1
	100.0
	(N = 1,965)

Question 8: Nature of change in diet

Which of the following precautionary measures did you take?

(only asked if question 7 was answered in the affirmative)

Present list G5
Multiple responses possible

	%
Because of Chernobyl, less salad and fresh vegetables eaten than before	93.7
Because of Chernobyl, less fresh milk and fresh milk products than before	65.0
Because of Chernobyl fewer mushrooms and less game than before	65.2
Other precautionary measures	28.0
	(N = 882)

Question 9: Perception of damage to personal health

Do you feel that you personally have suffered or will suffer injury to your health owing to the extra radioactivity?

	%
yes	15.1
no	45.6
don't know	39.2
	100.0
	(N = 1,958)

Question 10: Own children under age 6

Have you any children of your own under the age of 6 living in your household?

	%
yes	11.7
no	88.3
	100.0
	(N = 1,965)

Question 11: Changes in childrens' diet

Have you changed the diet of this child/these children on account of the radioactive contamination following the Chernobyl disaster?

(only asked if question 10 was answered in the affirmative)

	%
yes	53.6
no	46.4
	100.0
	(N = 215)

Question 12: Playing in the open

Did you allow yor child/children to play less in the open because of the Chernobyl accident?

(only asked if question 10 was answered in the affirmative)

	%
yes	49.2
no	50.8
	100.0
	(N = 213)

Question 13: Perception of damage to childrens' health

Do you feel that your child's health has been impaired by the extra radioactivity?

(only asked if question 10 was answered with in the affirmative)

	%
yes	17.2
no	43.5
don't know	39.2
	100.0
	(N = 215)

Question 14: Credibility of information

I will read you a list of institutions that published information on the facts of the Chernobyl disaster and issued recommendations for precautionary measures. Using this scale, tell me how reliable do you think the information provided by the various institutions was.

Present Scale 1
Read out names
Only one response possible

	completely reliable %	partly reliable %	partly unreliable %	completely unreliable %	don't know %	Σ %	N
The Federal Government	8.7	50.3	24.4	11.7	5.0	100.0	1,961
The Opposition	3.5	48.8	31.6	7.1	9.1	100.0	1,953
National nuclear research centers	12.6	41.4	23.9	10.5	11.5	100.0	1,955
The Ecological Institute associated with the Greens	8.6	42.8	22.4	10.8	15.3	100.0	1,954
Nuclear Energy Industry	4.8	29.4	28.3	24.9	12.6	100.0	1,957
Citizens' Action Committees against nuclear energy	9.5	42.6	24.1	10.4	13.3	100.0	1,948
Journalists	3.7	46.2	30.2	8.7	11.2	100.0	1,957

Question 15: Balance in television reporting

Television reported in detail on Chernobyl.

What do you think: was the television reporting -
- largely balanced,
- too negative as regards nuclear energy,
- too positive as regards nuclear energy
- or can't say?

	%
largely balanced	42.5
too negative as regards nuclear energy	13.5
too positive as regards nuclear energy	12.2
can't say	31.7
	100.0
	(N = 1,963)

Question 16: Factual accuracy of television reporting

Do you feel that television reporting was in the main factually correct, or do you feel that incorrect information was often broad cast?

	%
in the main factually correct	35.4
partly incorrect	41.3
don't know	23.4
	100.0
	(N = 1,963)